VOL. LXXXVI. No. 2204. [All Rights Reserved.] FEBRUARY 20, 1920. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of Postage.] PRICE SIXPENCE

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. 4. SUBSCRIPTION RATES, Postage Free: United Kingdom and Canada, £1 12s. 6d. per annum.; Colonial and Foreign, £2 1s. 6d. per annum.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOIVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
Telegraphic Address: "Ageekay, Cent., London." A B C Code. Telephone Nos. City 907; Central 4425 (Editorial only).

LITHOLITE INSULATORS, Ltd.
65—57, Hackney Grove, London, E. 8.
'Phone and Telegrams: Dalston, 592, London.
FIREPROOF AND OTHER GRADES.
ESTABLISHED NEARLY 20 YEARS.

ELECTRIC INSULATION.
NON-HYGROSCOPIC.
FIREPROOF.
SILUMINITE
SHEET and MOULDINGS.
'Phone: Southall 59.
THE SILUMINITE INSULATOR Co., Ltd.,
The Green, Southall, Middlesex.
See Large Advt. every alternate week.

T. H. FERGUSON, PAILIN, LIMITED, A. C.
SWITCHBOARDS.
L. T. EDWARD ST., Hr. Openshaw, MANCHESTER. Tel.: 330 Openshaw. C. D.

INSTRUMENTS, CIRCUIT-BREAKERS,
AUTO-CUT-IN & CUT-OUTS.
THE Record Electrical Co., Ltd.
BROADHEATH, MANCHESTER.
TELEPHONE: 164 ALTRINCHAM.

BROOK
ONE, TWO and THREE-PHASE
MOTORS.
See Sup. 54.

SWITCHGEAR
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors,
GREENLAND PLACE, CAMDEN TOWN, LONDON

NEW DISTRIBUTION BOXES.
THE CANTIE PATENT FUSE WILL CLEAR A "DEAD SHORT."
ALL CONNECTIONS FROM FRONT.
THE CANTIE SWITCH CO., LTD.,
67, MOUNT ST., NOTTINGHAM.

THE **SAXONIA**
ELECTRICAL WIRE CO., LTD.,
ALWAYS GREENWICH, S.E.
ALL BRITISH
FLEXIBLE CABLES.

CHURTON
SINGLE and POLYPHASE
MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

SKATOSKALO BOILER SCALING TOOLS.
Sole Maker:
FRANK GILMAN,
9, Westfield Road, BIRMINGHAM.
See Advertisement last week, page xxxvii.

"EMPIRE"
AUTOMATIC CONTROL
FOR
Pumps, Compressors, Machine Tools.
ELECTRIC CONTROL, LIMITED, GLASGOW.

WESTERN ELECTRIC
COMPANY, LIMITED,
Norfolk House, Victoria Embankment, W.C. 2
Works: NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
See Advertisement this week, page xiv.

CONNOLLY'S (BLACKLEY), Ltd.,
for
WIRES AND CABLES.
See Advertisement last week, p. iii.

STEEPLEJACKS
— Chimneys Raised, Felled, Straightened, Pointed and Banded. —
The CHIMNEY CONSTRUCTION and BOILER SETTING Co., Ltd.,
7, Princes Street, Westminster, S.W. 1.
Telephone: Victoria 6467. Telegrams: Chimbosela, Phone, London.

DIES & CUTTERS,
Press Tools, Punches, Die Stampings, Blanks, Checks, Tokens, also Name Plates, Instruction Plates, Meter Dials, Switchboard Labels, Advertising Novelties, Club Badges, Address Plates.
RELIANCE Engraving Co., Ltd., CHISWICK.

JULIUS SAX
FOR
BELLS.
Over 50 years' experience.

KNIFE SWITCHES.
See page xv.

MOTORS. • DYNAMOS.
VICTORIA DYNAMO & MOTOR CO.,
CRAVEN HOUSE,
Kingsway, London, W.C. 2.
'Phone: Gerrard 1245.

Makers of— **FULLER,**
WIRES & CABLES,
ACCUMULATORS,
BATTERIES,
CARBONS.
CHADWELL HEATH, ESSEX.

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

THE BRITISH
ALUMINIUM
COMPANY, LD.,
109, Queen Victoria St.,
See large Advt. Feb. 13, p. xxxii. LONDON, E.C. 4.

THERMIT, LIMITED,
(Proprietors: NOBEL'S EXPLOSIVES CO., LTD., GLASGOW.
675, Commercial Road,
LONDON, E. 14.
'Phone: EAST 4157. Grams: "FULMEN," PHONE LONDON."

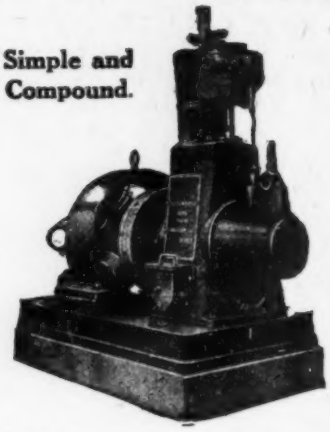
SAVE COAL by continuously testing your boiler plant with a
LEA V NOTCH RECORDER.
Thousands at work all over the World.
The LEA RECORDER Co., Ltd.,
28, Deansgate, MANCHESTER.

"M. E. M."
Ironclad Switch and Fuse Gear is both Simple and Efficient. Write us.
MIDLAND ELEC. MFG. CO., LTD.,
BARFORD STREET, - - BIRMINGHAM.

Advertisement Index, see page xxxvi.

VERTICAL ENCLOSED HIGH SPEED STEAM ENGINES.

Simple and Compound.



For Direct Coupling to Dynamos, Fans, Pumps, &c.

For Ship Lighting and Industrial Works of all kinds.

E. S. HINDLEY & SONS,

11, Queen Victoria Street, E.C. 4.

Works: BOURTON, DORSET. Telephone: City 9804. Telegrams: "Steamport, Cannon."

TUDOR ACCUMULATORS

FOR ALL PURPOSES.

HIGH EFFICIENCY — RELIABILITY

LONG LIFE.

TRACTION,
TOWN LIGHTING,
FACTORY POWER AND LIGHTING,
TRAIN LIGHTING,
MOTOR CARS, etc., etc.

THE TUDOR ACCUMULATOR Co., Ltd.,
3, Central Buildings,
Westminster, S.W. 1.

Telegrams: Subconical, London. Telephone: Victoria 816.

WORKS: Dukinfield, nr. Manchester.

MICA & MICANITE

INSULATORS FOR EVERY DESCRIPTION OF ELECTRICAL WORK.
Contractors for Air Board, War Office and Admiralty Requirements.
CUTTING AND GAUGING OUR SPECIALITY.
BEST QUALITY MICA ONLY.

'PHONE 4575 CENTRAL.
TELEGRAMS—"MICAYLOR, LONDON."

TAYLOR & PETTERS, LTD.,
40, HATTON GARDEN,
LONDON, E.C. 1
(The Oldest Established Mica House in the country.)
AND ALL BRITISH.

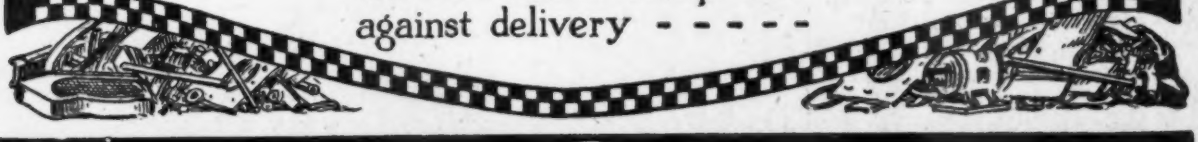
BUYERS OF SCRAP METAL LTD

GLYN STREET, VAUXHALL, LONDON S.E.11.

Telephone: HOP 4520

Offer your stocks —
state full description and quantity
Terms of Purchase — Prompt cash
against delivery - - - - -

Telegrams: "SCRABVAU" LONDON



Telephone: CITY 3115. Telegrams: "VANDUARA, CENT, LONDON."

Contractors to H.M. Government.

ELECTRICAL INSULATING **TAPES, WEBS, CORDS, SLEEVING, &c.**

DELIVERY FROM STOCK.

JOHN MACLENNAN & CO.,

30, NEWGATE STREET, LONDON, E.C. 1, AND AT 166, INGRAM STREET, GLASGOW.

S

TY

G,

tc.

l.,

1.

e:

ie.

er.

THE

ELECTRICAL REVIEW.

VOL. LXXXVI. FEBRUARY 20, 1920. No. 2,204.

ELECTRICAL REVIEW.

Vol. LXXXVI.] CONTENTS: February 20, 1920. [No. 2,204.

	Page
Railway Electrification	225
The Cost of Living and Trade	226
Trade Tours	226
Three-Phase Power	226
The Electricity Commissioners (*illus.*)	227
Electricity in Small Dwellings (*illus.*)	228
Extensions at Stuart Street Generating Station, Manchester (*illus.*)	230
The Ideal Home Exhibition (*illus.*) (*concluded*)	233
Correspondence—	
University Training	235
Projector Lamps	235
The I.E.E. Council and the Territorial Centres	235
Electrolytic Meters	235
Officers' Association (Employment Bureau)	235
Awards Delayed	235
Legal	236
Business Notes	237
Notes	224
City Notes	245
Stocks and Shares	248
The Protection of A.C. Systems without the Use of Special Conductors, by K. Edgcumbe (*illus.*)	249
The German Aluminium Industry	251
Scientific Management	252
Conference of Manufacturers	253
The Electrical Wholesalers' Federation, Ltd.	254
The Electrical Trade of Spain	254
New Electrical Devices, Fittings and Plant (*illus.*)	255
New Patents Applied for, 1920	256
Abstracts of Published Specifications	256
Contractors' Column	Advertisement page xxvi

THE PRICE OF THE "ELECTRICAL REVIEW."

Annexed will be found the revised rates for new subscriptions and for renewals:—

SUBSCRIPTION RATES, Postage Free.

UNITED KINGDOM and CANADA £1 12 6 per annum.

COLONIAL and FOREIGN .. .. 2 1 6 do.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGENCY, CENT., LONDON." Code, A B C. Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND N.Z.: Gordon & Gotch, Albert Street; Peter G. Tait, P.O. Box 392.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: Peter G. Tait, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

RAILWAY ELECTRIFICATION.

ACCORDING to recent reports, the necessity for immediate action to relieve the congestion on suburban railways has reached an acute stage. At the general meeting of the London, Brighton, and South Coast Railway Co. last week, the chairman stated that during the peak load the density of traffic on the railway between London and Croydon, and the number of trains entering and leaving the London termini, were so great that it was not possible to "squeeze in" even a single additional train, and the only hope of amendment lay in the extension of electrification; the relief afforded by the quicker working of electric trains was such that if they could electrify the whole of their suburban services they would be able greatly to improve the travelling facilities. *The Government was considering the problem.* Again, at the meeting of the Lancashire and Yorkshire Railway Co. on the same day, the chairman said the directors were satisfied with the results obtained on all the sections already converted to electric traction, and wished to extend the system to the line between Manchester and Oldham, Shaw, and Royton; but, again, *the matter was in the hands of the Government*, and until it was known what policy the Government would adopt with regard to the future of the railways, it was impossible to incur large expenditures—unless the Government provided the capital. Practically the same condition obtains in connection with the Great Eastern, South-Eastern, and other railways in urgent need of electrification.

The responsibility rests upon the Minister of Transport. Emphatic statements have been repeatedly made regarding the intention of the Government to embark upon large schemes of electrification of the railways, and the blessings to be derived from unified control; yet here we have various railways each capable of putting in hand such schemes, but blocked by the indecision and inertia of the very department which made such glowing promises. There is no need for the Ministry to undertake the design of railway schemes—let it delegate to the railway companies, which possess the staff and experience required, the duty of preparing the designs and carrying out the work. We do not wish to see the old conditions revived under which a consulting engineer felt it to be his duty to design the dynamos when he was called upon to advise on an electricity supply scheme—it is for the central authority to deal with the fundamental conditions and the results to be aimed at, not to busy itself with details, and there is no necessity for long deliberation over well-established principles.

Whatever the ultimate policy of the Government with regard to the railways may be, electrification is bound to come. Let the Government, therefore, guarantee the capital and allow the railway companies to go ahead with the work.

The Cost of Living and Trade.

It is stated, this week, that the cost of living advanced a further 5 per cent. during January, and there is reason to believe that while the rate of exchange in America continues unsatisfactory and the world competition to secure supplies of food and raw materials causes selling prices to advance, yet higher figures will be reached. Under the terms of the settlement with the railwaymen, they will automatically receive, on the cost-of-living basis, some millions a-year more. Almost inevitably, demands from other bodies will follow, preventing industry from reaching that state of stability which is so urgently necessary. Organised labour is not conspicuous for moderation; if it were, it would avoid agitations for ever-shorter hours until industry had had time to adapt itself to altered conditions. The House of Commons will shortly consider the question of a 48-hour week, while outside deliberations are proceeding for a still shorter week. The question now is how far one can go without seriously reducing output and increasing the cost of production.

Few matters are of more extreme importance, both now and for the almost immediate future, when we shall need all the trade that we can get, than the strength of our industrial position. At present that position is being weakened, and some of the most well-disposed employers are becoming weary of being in business, because of its overwhelming anxieties, and want to get out. We regard the claims of the workers most sympathetically, as our readers are aware, and we are anxious to see justice done to all—labour, black-coated staff man, and capitalist; but it needs to be shouted from the house-tops that there is danger ahead unless we pay regard to the national industrial good and refrain from the pursuit of mere selfish interest. "Betterment" for one section of the community may mean more acute distress for another. We have before us a New Zealand newspaper in which, in considering the electrical engineering and plumbing trades, a writer, after showing that New Zealand is now manufacturing in large quantities goods that were solely imported from Britain and other countries before the war, remarks: "The increased wages paid to the mechanic in the Old Country and the moderate tariff at present in existence, are factors which have enabled the Dominion manufacturers to enter into competition with the imported lines." We have not a word to say against British Colonial manufacturing, but it is high time that everybody recognised that there is a point where higher wages means reduced demand, unless the cost per article can be reduced by increased production. If we drive trade elsewhere, whether it be to the Colonies or to foreign countries, we shall be guilty of worse than folly, for we shall be laying up distress for others besides ourselves.

Trade Tours.

The Department of Overseas Trade has issued a small booklet giving a great deal of information respecting the touring exhibitions of British manufactures, which are probably to be organised by the Department. It is proposed that the exhibitions shall proceed to the Dominions, to South America, to the Far East, and to the U.S.A. For firms wishing to avail themselves of the opportunity thus afforded it should be possible to run for two years for about 200 guineas for a full unit of approximately 10 ft. frontage, and 120 guineas for half a unit. Facilities will also be offered for combined exhibits, either through trade associations or in groups. In order that the organisation may be completed at the earliest possible date, exhibitors should indicate what their requirements are likely to be. They should do this at the D.O.T. offices at the Fairs which open at London, Glasgow, and Birmingham next week. As the Dominions Tour must start at an early date, we would urge our readers to arrive at a decision as quickly as possible. Arrangements will be made for special kinema films showing processes of manufacture to be displayed in a number of towns just prior to the arrival of the exhibition, so that public interest may be stimulated in advance. The Department is now considering the establishment of showrooms at certain Continental centres in connection with the Commercial Secretariats or Consular offices. These will be available for a series of smaller exhibitions of from 25 to 35 exhibitors, which will succeed each other at intervals of one month, or less. If manufacturers and traders will get into touch with the Department, it will be possible to gauge the probable amount of support that will be forthcoming. We hope that the whole subject of these official exhibitions will receive immediate attention from those whose duty it is to decide the policy of participation.

Three-Phase Power.

The article which we published in our last issue, on the power plant of the Austin Motor Co., is of special interest, in that it is an example of the supersession of direct current by three-phase, and the subsequent extension of the latter on a vastly greater scale. As we have previously pointed out, we in this country are far too much wedded to the use of direct current, and this practice has distinctly handicapped us in the development of the electrical industry, not only at home, but also in our export trade. Unless we adopt the most up-to-date practice at home, we cannot be in a position to compete with it abroad. It will be noticed that a frequency of 50 cycles has been found preferable to 25, that there are over 500 motors in use, mostly squirrel-cage, and that the crane motors are of the slip-ring type, with resistance regulation. Only for charging the handy battery trucks is direct current required.

The experience of the Works Engineer's Department of the Company, first with the D.C. and subsequently with the A.C. system, has enabled a thoroughly practical comparison of the two methods to be made in relation to factory driving and lighting. This experience has told entirely in favour of the A.C. system. The chief difficulty with the D.C. generators and motors is the commutator and brush gear, which may be quite satisfactory so long as the machines work under steady conditions, not overloaded; but with irregular loads and overloading, which are bound to occur in any works of considerable size where extensions and alterations are of daily occurrence, and the electrical equipment cannot be immediately adapted to suit the purpose in hand, trouble with commutators and brushes sparking becomes insistent, involving labour charges and shut-downs, with loss of output. A.C. induction motors meet these conditions much better, and tide over the difficult times until a permanent arrangement can be made, with less trouble than D.C. motors. Under the best conditions the A.C. motors have the advantage of simpler wiring, no shunt or series field connections to be sorted out, cheaper prime cost, and more robust construction. All the speed variation required is easily obtainable by alteration of the pulley ratios, the motor being run under the ideal condition of constant speed. The only points requiring attention are keeping the motor clean by blowing out with compressed air once a week, or at other periods, according to the surrounding conditions and the lubrication. Though over 500 A.C. motors are in use day and night in this factory, under all sorts of conditions, about one breakdown per week or 10 days, and that not a serious one, represents the casualty list. The method employed is to standardise so far as possible, adopting a few sizes only, and keeping a reasonable number of spares, so that on the slightest failure the motor affected is taken down, and within a few minutes another is put in its place with a minimum of delay. Another point in favour of alternating current is that full advantage can be taken of medium pressure up to 550 or 600 volts for economical transmission, for use directly on the motors, lighting at low pressure being supplied through highly efficient transformers at suitable places. This is done very satisfactorily with delta primary and star secondary, with 110 volts phase to neutral, meeting every requirement of the factory. The average power factor obtained is between 0·80 and 0·85 for the whole system.

THE ELECTRICITY COMMISSIONERS.

The Minister of Transport has appointed Sir John F. C. Snell, M.Inst.C.E., to be chairman of the Electricity Commissioners, and Mr. H. Booth, O.B.E., of the Board of Trade, Mr. W. W. Lackie, C.B.E., M.Inst.C.E., M.I.E.E., and Mr. Archibald Page, M.I.E.E., to be Commissioners. All communications for the Commissioners should be addressed to The Secretary, Electricity Commissioners, Gwydyr House, Whitehall.

Photo by] [Romney.

W. W. Lackie.

Sir John F. C. Snell is a past President of the Institution of Electrical Engineers and a Member of Council of the Institution of Civil Engineers. He was formerly in practice as a consulting engineer in Westminster, as senior partner of Messrs. Preece, Cardew, Snell & Rider, and has been borough electrical and tramways engineer at Sunderland.

Mr. H. Booth, O.B.E., Principal Clerk in the Board of Trade, was a member of the Electric Power Supply Committee.

Mr. W. W. Lackie, C.B.E., joined the Electricity Department of the Glasgow Corporation in 1892, and was appointed chief engineer in 1904, and manager-engineer in 1915. He is a past president of the Incorporated Municipal Electrical Association, and the West of Scotland Institution of Engineers and Shipbuilders, and has been chairman of the Scottish Centre of the Institution of Electrical Engineers.

Mr. Archibald Page, who has resigned the general managership of the Clyde Valley Electrical Power Co. to become an Electricity Commissioner, joined the staff of the Glasgow Corporation Electricity Department in 1899, and occupied the position of deputy city electrical engineer from 1905 until 1917, when he became associated with the Clyde Valley Power Co. Mr. Page is a past chairman of the Scottish Centre of the Institution of Electrical Engineers.

The foregoing announcement will be welcomed by the electrical industry, which has waited long enough, in all conscience, for it; let us call to mind that it was in April, 1916, that Mr. Ernest T. Williams expounded to the Institution of Electrical Engineers his scheme for the complete reorganisation of electricity supply in this country—nearly four years ago! Let our readers turn back to Mr. Williams's scheme, as we have done, and they will be astonished at the close resemblance between his original conceptions and the provisions of the Electricity Supply Act of 1919, as regards not only the fundamental principles involved, but also the methods of putting them in force.

The fulfilment of that far-sighted scheme has been entrusted to the four men named above, with one other not yet appointed. That the Board of Commissioners thus formed will meet with the approval and command the confidence of the electrical industry we fully believe; every one of them is well known to the industry, and each has an admirable record of experience and achievement in his own branch of work to justify his selection. We have but one criticism to offer—one that, we are certain, will be endorsed by many of our readers—namely, that the name of Mr. S. L. Pearce is not included in the list.

Mr. Pearce, for many years, has stood at the head of the municipal electrical engineers of this country; he has presided over the fortunes of the largest undertaking of its kind with an efficiency and competence which need no emphasis from us; he has also played a leading part in the problem of National Electricity Supply, having presided over the Committee of Lancashire and Cheshire Engineers whose admirable reports exerted so great an influence on the course of events—particularly the second, which largely foreshadowed that of the Williamson Committee itself.

Surprised at the omission of his name from the list of Commissioners, we immediately inquired of Mr. Pearce the reason, and he informs us that "no invitation to join the Board of Commissioners was extended" to him. We are absolutely at a loss to understand the circumstance, which appears to us inexplicable. However, in his brief reply to our inquiries, Mr. Pearce says that "it is up to us now to all pull together and support the chosen Commissioners in the great work that lies before them," and with that generous sentiment we cordially agree. We trust that their labours will be fruitful, and crowned with a full measure of success; they have an exceedingly difficult and delicate task to accomplish, calling for the highest qualities of strength, wisdom, and discretion; and we hope that all electrical men will endeavour to smooth their way, and thus unite in promoting the national welfare.

Photo by] [Gillillan

Arch. Page.

ELECTRICITY IN SMALL DWELLINGS.

The extensive schemes which are being prepared to alleviate the present housing shortage afford an unprecedented opportunity to the electrical industry in general. Now, undoubtedly, is the time to press for the installation of electrical wiring and fittings while dwellings are in process of construction. Much of the reluctance to install electricity in existing buildings is due to the anticipation of the expense likely to be incurred in cutting away for wires and conduits, and the subsequent restoration. This trouble however, would be entirely eliminated if builders, or those responsible for building, were far-sighted enough to arrange for the use of electricity in the same way as gas is at present provided for. They might even go so far as to provide for electricity alone, in which case the resultant saving in brickwork—fireplaces, flues, and chimney stacks—would more than compensate for the expense incurred. The superiority of electricity over gas for domestic purposes cannot be overlooked, and its growing ascendency should receive attention in all schemes of reconstruction.

Where space has to be cut down to a minimum, the air is given a higher value by the employment of electricity,

Fig. 1.—"Henley" Joint Box.

Fig. 2.—"Henley" Connector.

which does not vitiate the atmosphere in the very least. Electricity is clean and smokeless, ensuring a much longer period of service for interior decorations and fixtures. There being no actual combustion on the premises, the risk of fire is greatly reduced, and also, as previously remarked, if cooking and heating are done electrically, fireplaces and flues become unnecessary.

If a tenant takes a house and finds it already fitted with most of the requisites for lighting and cooking electrically, he will almost certainly elect to use them, as it will mean little or no expense to himself, while the advantages are obvious. On the other hand, he will hesitate to install electricity on his own responsibility, as, should he wish to vacate the house, the wiring, erected at his expense, becomes the property of the landlord, and has to remain where it is, and in his new dwelling he may have to start all over again.

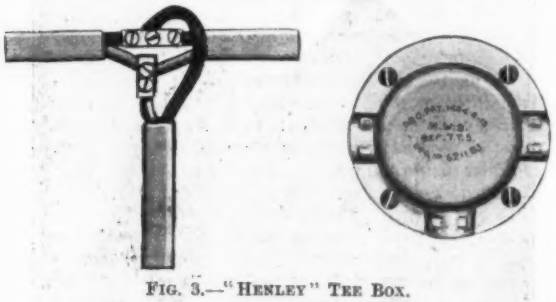


Fig. 3.—"Henley" Tee Box.

One of the first considerations to occupy the attention of builders and prospective consumers is the system of wiring to be adopted. The three points to be studied are cheapness, effectiveness, and sightliness. The conduit system, although effective and possessing many advantages, is generally out of the question in small buildings, where the low rental will not recoup the outlay involved. Wiring in wood casing is at the present time even more expensive, and so it becomes necessary to look for a good open or "surface" system. The method of wiring with porcelain cleats at intervals can be made very effective and unobtrusive, but there is always a tendency for the leads to separate, slacken, and sag down, thus becoming very unsightly. There are, however, several modern systems devised to avoid these defects; of these the "Henley," "Kaleeco," and "Stannos" are probably the best known. The main idea of such systems is, of course, to comply with the three requirements referred to above, and chief attention is paid to the external or visible features of the installation. If the leads from the mains can be installed while a building is being erected, little trouble is encountered, as all cutting-away of the fabric is obviated.

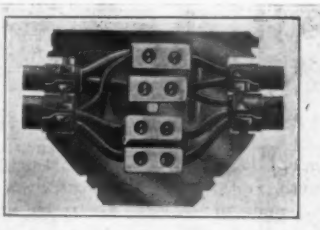


Fig. 4.—"Kaleeco" Joint Box.

Wires run in a roof may be fixed with porcelain cleats, and where they are brought in at right angles to a joist, the latter should be drilled with two holes about an inch apart, through which the wires are threaded. If run parallel with a joist in the ceiling or roof, they can again be fixed with cleats.

The wires in the "Henley" system are made up in pairs and sheathed with metal, which takes the place of a conduit

Fig. 5.—"Stannos" Wiring and Clips.

or other external protection. Wires running together are retained in position and clamped by means of small clips, which prevent sagging. Where leads are exposed, they may be painted the same colour as the wall or background to render them inconspicuous. Jointing is effected by means of small porcelain and brass connectors enclosed in small joint boxes (figs. 1, 2 and 3). Branches are taken off by means of small tee boxes of tinned brass.

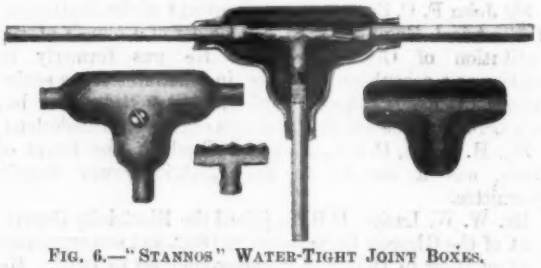


Fig. 6.—"Stannos" Water-Tight Joint Boxes.

"Open" wiring can also be effected by means of the "Kaleeco" system, in which sheathed conductors are employed. Single wires are circular in shape, while multi-core cables are of flat section. The distinguishing feature of the "Kaleeco" wiring system is the method of jointing. The joint boxes consist of two parts, backplate and cover of tinned brass. The backplate can be slotted to take any arrangement of wires, and the slotting produces tongues which are fixed to the wires by means of bonding clamps (fig. 4) and tightened by bolts and nuts.

The backplate is fixed in position and the joints are made with porcelain-sheathed connectors. Lugs are provided on this plate which fit into slots cut in the cover, and are bent over, thereby obviating the use of fixing screws or bolts to hold the two parts together. Wires covered in silk or glace cotton in various colours are supplied, in order that external wires may harmonise with their surroundings.

The "Stannos" system is another effective form of open wiring—similar in many respects to the "Henley" system. The wires employed are of the metal-sheathed type, which

can be used either for two-wire work, or by the utilisation of the copper sheath as a conductor, for concentric systems. Metal clips are used for retaining the wires in position (fig. 5), and a protective steel covering (fig. 8) can be used in positions where exposed wires would be liable to be damaged. The small joint-boxes employed in the "Stannos" system consist of a soft metal base and cover, two porcelain linings, and a soft metal channel connector (fig. 6).

The original mode of distribution was to tap off the mains for each house, which meant great expense in the provision of suitable underground junction boxes. The cheapest way of supplying a block of houses is to make one tapping only from the street mains, and then run leads along the front (or back) of the row of houses, taking off a branch at each dwelling or pair of dwellings. These branches can be made secure and weatherproof at a mere fraction of the cost of separate underground joints.

Fig. 7.—"Stannos" Service Main.

Figs. 7 and 9 show this principle carried out by Messrs. Siemens Bros., the originators of the "Stannos" system. The houses are served by leads entering above the front doorway, and the outside cables are very unobtrusive.

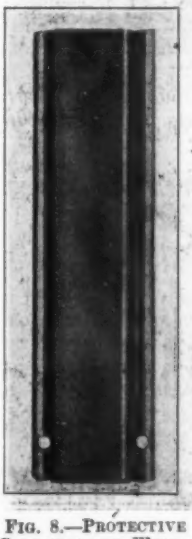


Fig. 8.—Protective Covering for Wires.

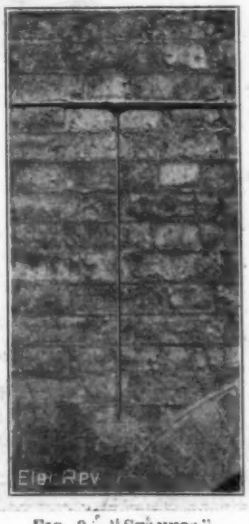


Fig. 9.—"Stannos" Service Branch.

Many methods of payment for electrical energy in the case of small houses are in vogue; probably the best system is that adopted by the Fixed-Price Light Co. This company's system was described in the Electrical Review of May 15th, 1914, and has proved so effective that little or no modification of the original scheme has been found necessary. The company carries out complete installations and charges a weekly amount for each lamp installed, varying with the candle-power. All replacements are made by the consumer. The meter system employed by many supply authorities is expensive both in first cost and in maintenance, and for this reason is gradually giving place to the more economical method of flat-rate payment. To guard against excessive consumption in houses receiving a supply on the "fixed-price" system, current limiters are usually installed, which act when more than a certain number of lamps are in use in any one dwelling. The recently inaugurated Wolverhampton scheme is run on these lines. Meters of the 1d. and 1s. prepayment type are frequently placed in houses, and although a charge has to be made for their maintenance, there is no doubt that many consumers prefer this method of payment by degrees.

In conclusion, as an example of completely electrical dwellings, we would draw attention to the experiment carried out at Glasgow. Two houses were fitted with electrical heating and cooking apparatus, lighting, and household appliances. The cost for a year's running was £32 in one case, and £35 in the other, and the occupants expressed great satisfaction with the scheme, and gave electrical methods preference over the usual domestic routine.

Faraday Works War Fund.—A general meeting of the subscribers to Faraday Works (Gent & Co., Ltd.) War Fund was held on the 2nd inst. at Leicester. The chair was taken by Mr. I. H. Parsons, supported by Messrs. Waddington and Skinner. Mr. Parsons briefly reviewed the organisation and history of the fund. In the early days of the war the employés made weekly collections in aid of the Prince of Wales's Fund, and in April, 1915, it was agreed to devote future funds to cases of need among the firm's employés with H.M. Forces. Parcels were sent according to a properly established plan during three or four years, and a sum was handed to each man on his return. Money grants were also made to widows and other relatives of fallen men. From time to time contributions were forwarded by the committee to a number of charitable organisations. The Treasurer reported that although the weekly collections had ceased, he had a balance in hand of £109. It was decided by the meeting that part of this should be distributed among relatives of fallen men, the balance to be spent in entertaining all returned men at a dinner and social evening. The firm had expressed a wish to erect a permanent roll of honour to record the part which its employés had taken in the war. It had been decided to fix a marble tablet outside the works bearing the names of fallen men, and to erect a roll of honour inside the works. The employés have expressed a wish to subscribe part of the cost, and this has been agreed to. The committee has now been made a standing one, as Gents' Social Committee. The Secretary (Mr. W. E. Dunt) would be glad to receive the present addresses of any men who joined up when in the firm's employ, but who may now be in other employment.

EXTENSIONS AT STUART STREET GENERATING STATION, MANCHESTER.

THE latest extensions at the Stuart Street station of the Manchester Corporation electricity department comprise, as already briefly reported in our pages, a 25,000-KW. turbo-alternator, together with condensing plant and cooling towers, and four large water-tube boilers with economisers. It has been necessary to remove a portion of the original plant which was installed in 1902—namely three 1,500-KW. alternators driven by vertical reciprocating engines, and twelve 12,000-lb. per hour water-tube boilers, to make room for the new turbo-alternator, condenser, and boilers respectively. Considerable structural alterations were necessary in the boiler house. The old roof had to be removed and steelwork erected to carry the new economisers and to support the existing bunkers.

The four new boilers, shown in fig. 1, are of Messrs. Babcock & Wilcox's marine type, fitted with superheaters and Green economisers. The boilers normally evaporate 91,000 lb. per hour, but have a continuous overload rating of 104,000 lb. of water per hour from, and at, 212° F. The working pressure is 225 lb. per sq. in., and the superheat 275° F. The boilers have a total heating surface of 14,000 sq. ft. and the superheaters 5,145 sq. ft., the grate surface being 416 sq. ft. The main steam drum is 4 ft. 6 in. in diameter, 37 ft. long, and weighs 12 tons. There are 56 sections of tubes per boiler, each section having 12 tubes 17 ft. long. Each boiler has four chain grates driven by Brampton chains from the stoker shafting, which is placed in the ash passage. This shafting is driven through reduction gearing by one A.C. and two D.C. motors, one of these motors being always used as a stand-by to the other two. Forced and induced-draught plant is fitted to each boiler, there being four 45-in. diameter forced-draught fans, each direct-driven by a 36-B.H.P. motor at 360 R.P.M. They are capable of maintaining a pressure of 0·5 in. W.G. under the grates, and will deliver sufficient air for the combustion of coal at the rate of 36 to 40 lb. per sq. ft. of grate surface per hour.

FIG. 1.—B. & W. 91,000-LB. WATER-TUBE BOILERS.

Suitable dampers are provided for isolating each economiser. Each boiler has two economisers installed above it, each economiser having 256 tubes and a heating surface of 3,697 sq. ft. The gases enter the economisers at a temperature of 560° F., and are discharged at a temperature of 375° F., the temperature of the feed water being raised

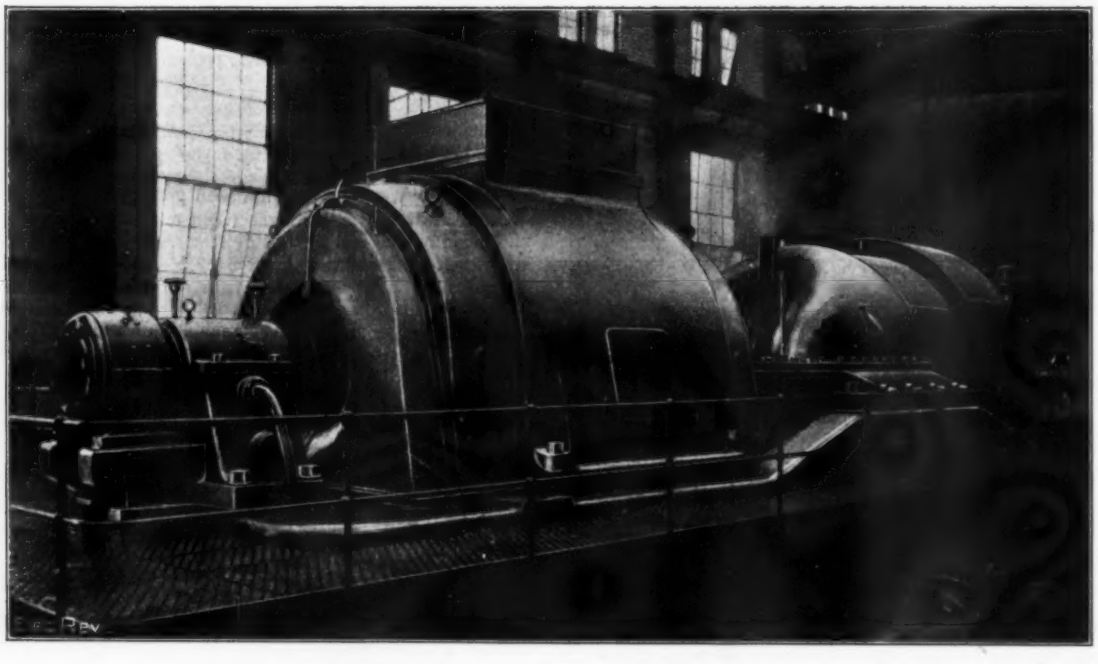


FIG. 2.—ALTERNATOR END OF METROPOLITAN-VICKERS 25,000-KW. TURBO-ALTERNATOR.

Two of the boilers have each one 60-in. diameter induced-draught fan, direct driven by a 70-B.H.P. motor at 360 R.P.M. These fans draw the gases from the economisers, and discharge into 7 ft. 6 in. diameter steel chimneys, which have a height of 93 ft. above the grates. The fans are capable of maintaining a draught of 2 in. water gauge at the economiser outlets. The other two boilers have one 85-in. diameter fan, which discharges the gases into an existing brick chimney. The motor for this fan, which is chain-driven, is of 155 B.H.P. The speed of the motor can be regulated by rheostatic control from 585 to 450 R.P.M.

100° F. The overall efficiency of the boiler, superheater and economiser is 82 per cent. when burning "slack."

Some modifications have been made to the coal chutes, &c., and the fuel now used consists of coke breeze and coal, and is fed on to the grates on the "sandwich" system—

that is, a layer of coal on top of a layer of coke. An additional coal elevator and a conveyor of the push-bar type, having a capacity of 60 tons per hour, have been supplied by Messrs. Jenkins, Ltd., of Retford.

The new feed pump was supplied by Messrs. Weir and Co., of Cathcart, and is capable of delivering 25,000 G.P.H. when running at a speed of 5,000 R.P.M. It is of the single-stage type, direct driven by an impulse steam turbine, fitted with a ratio governor of the differential-

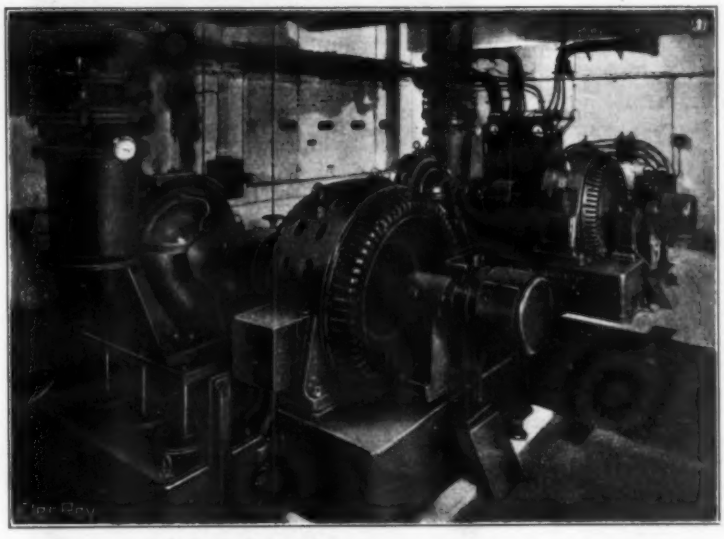


Fig. 3.—Mather & Platt Circulating Pumps.

piston type, also an overspeed governor. The exhaust steam is discharged through a nozzle into the hotwell tank, and is used to heat the feed water.

Messrs. Richardsons, Westgarth & Co., of West Hartlepool, were the main contractors for the turbo-alternator and condensing plant. The contract for the three-phase alternator, fig. 2, which has a maximum rating of 25,000 KW., at 0·85 power factor, 6,600 volts, 50 cycles, was sub-let to the British Westinghouse Co., now Metro-

cast-steel concentric pipe inside the turbine casing. The high-temperature steam, therefore, does not come into direct contact with the casing. The main governor operates the throttle valves by means of oil relays; hand-operated nozzle valves are also fitted to the turbine. The over-speed and emergency governor is of the centrifugal spring-loaded type, fitted to the shaft, and is set to operate at 10 per cent. overspeed; levers are also fitted to this governor, so that it may be operated by hand in case of emergency. Two oil pumps are driven by gearing from the end of the shaft in the usual manner, but a separate steam-driven reciprocating oil pump has also been installed for starting and shutting-down purposes. This pump is fitted with an automatic governor, which will start the pump when the oil pressure falls to 27 lb. per sq. in., if the main pumps fail to maintain the supply.

It is interesting to note that the alternator stator was built up on site to avoid the difficulties which would have been experienced if such a heavy weight (70 tons) had had to be handled with the existing crane. An exciter is fitted to the machine, but arrangements are made so that the supply of energy for excitation can be taken from the station battery when required. Ventilating fans are fitted on the rotor, which runs at a speed of 1,500 R.P.M. These fans draw air direct from the atmosphere through wet air filters of the rotary type, which were supplied by Messrs. Heenan and Froude, Ltd. Duplicate A.C. motors, with direct-driven pumps, are provided for circulating the spray water and rotating the filters.

Messrs. Reyrolle's self-balanced protective gear has been fitted to the alternator.

The main cables connecting the alternator to the oil switch are of the single-core, lead-covered, paper-insulated type, 1 sq. in. in cross section, three being used per phase.

The condenser, which is of the "Contraflo" type, is on the turbine room floor, the turbine and alternator being about 16 ft. above this level. The condenser is mounted on

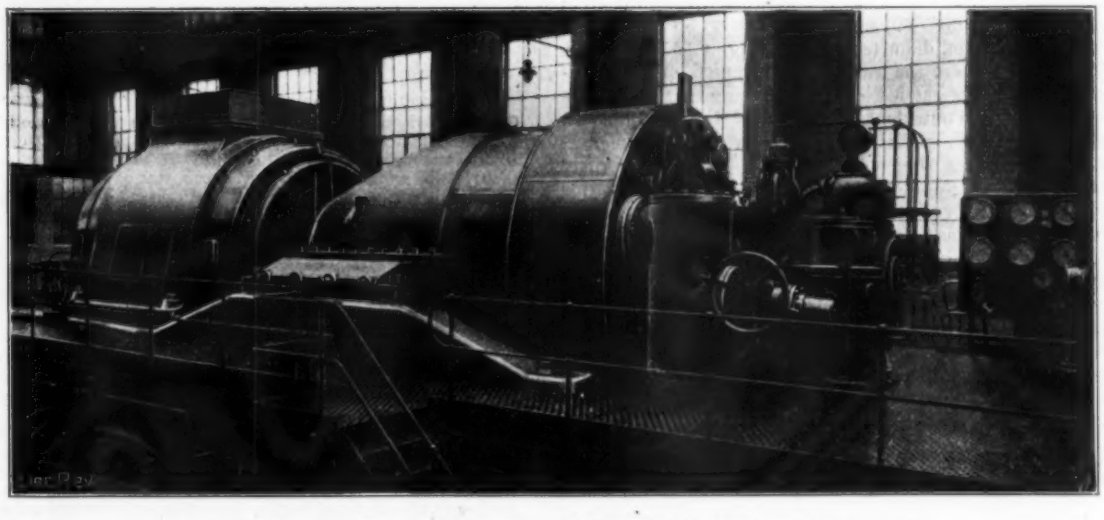


Fig. 4.—Turbine End of Metropolitan-Vickers 25,000-kw. Turbo-Alternator.

politan-Vickers Electrical Co., Ltd. The turbine is of the impulse-reaction type, the steam pressure at the stop valve being 200 lb. per sq. in., the temperature of the steam 600° F., and the vacuum 28 in. of mercury.

Steam is supplied to the separator through an 18-in. pipe, and thence through two 12-in. diameter pipes to the valve chests, which are fitted on each side of the turbine. The steam passes to the nozzle chest, which is in the form of a

spring supports, and is bolted direct to the turbine exhaust flange. The shell is of mild steel, and was built up on site. The amount of water circulated through the condenser is 1,800,000 gallons per hour; the tubes are of 1-in. external diameter, and the total cooling surface is 40,000 sq. ft.

The air and water-extracting pumps are of the "Kinetic" type. Each set runs at 1,475 R.P.M., and is capable of maintaining the vacuum and of dealing with the full-

load condensate. One set is driven by an A.C. motor, the other being driven by a De Laval steam turbine. Each set has three steam jets for air extraction, and arrangements are also made so that the auxiliary turbine exhaust steam may be used in the jets, or diverted into the kinetic tank and used to heat the condensate. Messrs. Mather & Platt, Ltd., have supplied two 27 in. circulating water pumps, each direct driven by a 550-B.H.P., A.C. motor at 590 R.P.M., and capable of dealing with 60 per cent. of the full-load

Fig. 5.—Cooling Towers.

requirements; these pumps, fig. 3, are installed in a room which is external to the main building.

Two cooling towers, fig. 5, have been supplied by Messrs. Charles Bradshaw & Co., and have a total capacity of 1,320,000 gallons of water per hour, the temperature being reduced from 95° F. to 75° F. when the atmospheric temperature is 60° F. and humidity 80-85 per cent. Twenty-four 11-in. diameter fans running at 165 R.P.M. are fitted to the sides of the towers and mounted on through-shafts, which are carried on lignum vitæ bearings inside the towers. The outside bearings are of the oil-ring type, and are fitted with special waterproof covers. On one side of the towers are the motor houses, which contain six 80-B.H.P. motors; each motor runs at 730 R.P.M., and drives two shafts, *i.e.*, four fans, by means of chains. The towers are divided into sections corresponding to the motors, and the troughing and pipes are so arranged that each section can be worked quite independently of the others.

The main 6,600-volt switchgear was supplied by the British Thomson-Houston Co., and comprises one 3,000-ampere alternator oil switch, three 2,000-ampere group-feeder switches, and one feeder board with six switches. The large switches and the feeder switches are the H 6 and H 3 types respectively, with two oil tanks per phase. The whole of the equipment is mounted in moulded stone cubicles.

Brick cubicles have been built for the transformers which have been installed in connection with the supply of energy for the A.C. motors. Two cubicles are in the boiler house, two adjoining the circulating-pump house, and one beside the cooling-tower motors.

The 6,600-volt switchgear for controlling the supply to these transformers is erected on the switchboard gallery in the turbine room, and comprises a number of the Manchester standard sheet-iron cubicle type of sub-station panels. An iron-clad Fluvent board, with knife switches and fuses, is mounted on top of the boiler-house transformer cubicles, and black enamelled slate panels with knife switches have been fitted in the pump and tower motor houses to control the 420-volt circuits.

The whole of the cable work has been done by the Stuart Street staff; the H.T. and L.T. cables for the auxiliary circuits being three-core, paper-insulated, lead-covered and armoured.

The war memorial tablet illustrated in fig. 6 was erected by the men employed at the Stuart Street works, to the

Fig. 6.—War Memorial Tablet.

honoured memory of 25 of their comrades who volunteered for service and gave their lives in the great war.

In conclusion, we have to thank Mr. S. L. Pearce, chief engineer and manager, for supplying and permitting the publication of the particulars set out above. The photographs were taken by Messrs. Grundy & Sons.

The Neuhausen Aluminium Co.—During the war the German State-guaranteed War Metals Co. entered into a contract with the Aluminium Industry Co., of Neuhausen, for the supply of aluminium, which is said to be still in operation, notwithstanding that the war requirements expired over a year ago, and the German company is still under the obligation to accept deliveries. To do so now would be all the more burdensome, as the basis price was arranged in Swiss francs (5.50 fr. per kilo is mentioned), and would, therefore, involve a considerable sacrifice owing to the increasing fall in the mark. A friendly arrangement, however, has been made with the German Government, under which the contract has been determined on the payment of a sum of 11,000,000 fr. to the Swiss company.

Norwegian Aluminium.—The managers of the A. S. Hoyangfaldene (Norsk Aluminium Co.) state that it was possible for the company to begin the production of aluminium last October, but owing to the difficulties in connection with supplies of coal and transport services, the company has been unable to increase the deliveries of raw materials to the level corresponding to the utilisation of the full capacity of the plant. There are, however, reasons for believing that this will take place in the near future. At present the electrode factory is turning out electrodes for the company's use, which was the original object in view, although considerable quantities could also be produced for sale, but the demand in Norway is inconsiderable at present, presumably on account of the restricted activity at the smelting works. The prospects for the export of aluminium seem to be favourable. No doubt the unfavourable rate of exchange for Germany renders it difficult for exports to be sent to that country, where the consumption is very large just now. On the other hand, the consumption appears to be increasing in other industrial countries, and there is every reason for believing that this will continue. The sale prices are still low as compared with the costs of production, but it is considered probable that the advance which has begun will be maintained.

THE IDEAL HOME EXHIBITION.

(*Concluded from page* 201.)

Messrs. Arthur Lyon & Wrench, Ltd., 36, Victoria Street, London, S.W. 1, exhibit electric lighting sets suitable for country-house lighting, as shown at other recent exhibitions; a combination electric motor positive pump, with a capacity of 500 gallons per hour; a motor-generator set driven off the Olympia main supply, and giving an output of 50 to 70 volts, 25 to 35 amperes; a small ¼-h.p. motor for driving a sewing machine or other household appliances requiring small power, and some domestic heating and cooking accessories for working in conjunction with L.W. house-lighting plant.

The Austin Motor Co., Ltd., 479-483, Oxford Street, London, W. 1.—This is a working exhibit of an entirely British-made 0.75-kw. automatic electric lighting plant for a country house or farm, and a 10.5-h.p., 100-volt, automatic plant for country mansions, reference to the commencement of the manufacture of which was recently made in our pages. The smaller set under the name "Autoplant" is suitable for an installation up to a total capacity of 800 c.p. with 25-volt standard metal-filament lamps, or 1,500 c.p. with half-watt lamps. The set comprises a 1.75-h.p., four-stroke, single-cylinder engine designed to run at 1,100 r.p.m. on either petrol, benzole, or town gas, and is supplied complete with all piping, &c. The cylinder is water cooled, the radiator taking, not the usual form, but that commonly employed for office and room warming purposes, as shown in fig. 11. The engine is direct coupled to a compound-wound dynamo giving an

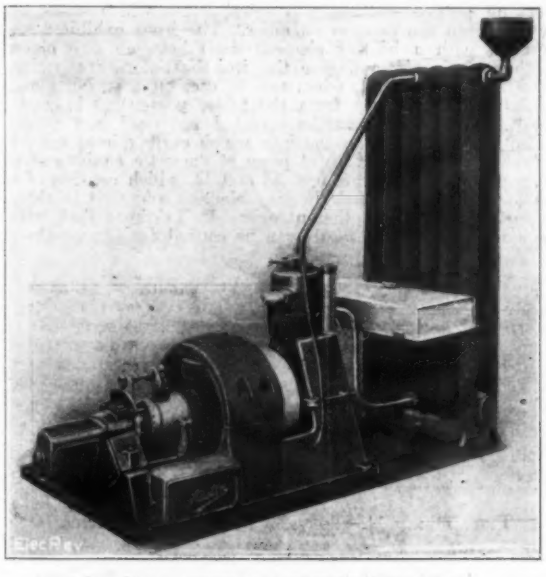


Fig. 11.—Austin 0.75-kw. Lighting Set.

output of 30 to 22 amps., at 25 to 35 volts, or 15 to 11 amps. at 50 to 75 volts; a battery of from 126 to 180 amp.-hours capacity, according to the number of lights, is used with the plant, a feature of which is a "master instrument" which maintains the voltage on the lights at a constant value, although the dynamo may be giving a varying voltage for charging the battery. It is claimed that the plant is entirely automatic in its action, *i.e.*, self-starting, stopping, and regulating, even the h.t. ignition current being taken from the dynamo. Plant with capacities up to 12 kw., as well as 50-volt sets can be supplied.

Messrs. R. A. Lister & Co., Ltd., 47, Victoria Street, London, S.W. 1, exhibit electric lighting and power plant, suitable for country houses or where a main supply is not available, which is claimed to be automatic in action. The plant is suitable as a standby on board ships or elsewhere, and in such a case starts up automatically on the failure of the main supply; it also tests itself daily, and gives indication if not operating correctly. A feature is that the usual large storage battery is not necessary, a few cells suffice to work the plant automatically and light a few lamps without the engine running. The vertical, water-cooled, enclosed-type engine is of substantial construction, fitted with automatic lubrication, h.t. magneto ignition, and pump-fed carburetter. In addition to the centrifugal mechanical governor, a magnetic governor is fitted to the engine, which regulates the speed according to the load, thereby maintaining constant voltage at all loads. The shunt-wound dynamo is automatically lubricated and coupled to the engine either by a flexible coupling in the larger sizes, or by belt in smaller, single-cylinder sets, which have outputs of from 0.52 to 1.95 kw., 11 to 35 amps., at 55 volts. The direct coupled 1, 2, and 4-cylinder sets, fig. 12, run at 850 r.p.m., and give 3 to 18 kw., 27 to 163 amps., at 110 volts. An automatic controller is provided to start the engine up smoothly, the compression being released until sufficient speed is attained to

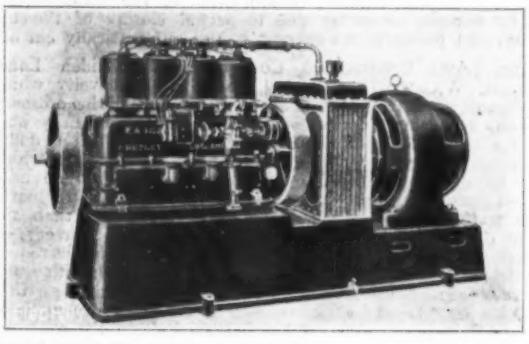


Fig. 12.—Lister-Bruston 18-kw. Lighting Plant.

ensure easy starting. The enamelled switchboard is fitted with a voltmeter, two ammeters, a Bruston relay, circuit breaker, fuse, and the necessary terminals are plainly labelled.

The Aster Engineering Co., Ltd., Wembley, Middlesex, has a working exhibit of a single-cylinder, semi-automatic house lighting set running on gas, but which will run equally well on petrol or paraffin. The exhibit is complete with all the necessary equipment, the design being sturdy throughout. The engine is of the 4-cycle type with mechanically operated overhead valves, and is air cooled; lubrication has received special attention, and a simple form of carburetter is fitted.

Messrs. Studebaker, Ltd., 117-123, Great Portland Street, London, W. 1, show the compact "Lally Light" house lighting plant, consisting of a generator direct driven by a ball-bearing petrol engine, and a set of accumulators. A duplicate set may be seen working outside at the rear of the stand. The 1.5-h.p., 1,800-r.p.m. engine has only three moving parts, namely, the piston, connecting rod, and crankshaft. There are no valves to grind, no connecting rods, push rods, cam shafts, &c. Thermo-siphon cooling with an ordinary water tank is employed. A float-feed type carburetter is fitted, and the h.t. magneto is direct connected to the crankshaft by means of a flexible coupling. A centrifugal governor running in an oil bath acts through a rocker arm directly on the balanced plunger throttle which governs the mixture in the engine. Simplicity in design has been aimed at throughout; the set weighs only 322 lb., it being 27 in. long by 14 in. wide.

Carron Co., 50, Berners Street, London, W. 1.—Amongst this selection of fireplace suites, some of which are seen working, are both coal and gas fires, as well as the firm's well-known electric fires of various sizes and styles.

The Dowsing Radiant Heat Co., Ltd., 39, York Place, Baker Street, London, W. 1, has on view a large number of samples of its manufactures in the shape of domestic electric heating and cooking appliances, including radiators, cookers, kettles, irons, toasters, &c., as described on various occasions in our pages. A special feature is made of electrically-heated clothing, while electro-medical apparatus on view includes electric light baths and various forms of vibrators. The De Vry portable kinema projector, which we described fully some time ago, is also to be seen in use at this stand. Messrs. Dowsing have taken up a selling agency for this apparatus, which is very compact, self-contained, and may be connected to any existing lighting fitting. It has been used with much success in schools and by educational authorities in different parts of the country.

The Filbar Electric Heater, Ltd., 46, Berwick Street, London, W. 1, is showing electric water heaters and sterilisers; the latter apparatus consists of a tank holding water on the bottom of which rests a tray for carrying the instruments to be sterilised, and which can be lifted out at will while the water is boiling. Parallel to this tank is a second tank containing a float which works in conjunction with a switch and cuts off the current should the water fall to a pre-determined level. The electric water boiler is designed to deliver a limited amount of hot water in a short space of time. The amount of water necessary can be drawn off at boiling point 30 to 60 seconds after the cold water has reached the desired level in the gauge. Immediately after the boiling water has been ejected, the apparatus is again ready for use. The

boiler can be used in a room where there is no water supply by the addition of a small tank; the heating element cannot be switched on until water has been admitted to the boiler, and water is admitted by a push rod valve which closes on the pressure being released. The "hotspring" automatic water heater is a small apparatus which can be easily fitted (and as easily removed) to the water main or to any existing cold water tap, the handle of which controls the whole apparatus. The only operation necessary to obtain a flow of hot water up to 160 deg. F. is to turn on the cold water tap, which action operates a water switch. When the tap is closed current is automatically cut off and current cannot be switched on to the heating elements unless water is flowing through the heater. In the event of the water supply failing entirely or partly due to partial closing of the tap or reduced pressure, the current is also automatically cut off.

The Lowa Engineering Co., Ltd., 25, Maiden Lane, London, W.C. 2.—The "Lowa" switch is a novelty which has many applications; it is slightly larger than the ordinary switch, and can be easily substituted for the ordinary one. It is a modification of the tumbler action in which a dolly-head operates a lever moving through a quadrant which cuts in or out groups of special resistances, and when used in conjunction with a lamp or series of lamps effects a remarkable saving in energy when less light is required than the rated c.p. The switch is suitable for bedroom, nursery, or hospital use, and for many purposes where it is desired to regulate the light given. It is also adapted for use with small motors, fans, radiators, &c., in place of the usual starting switch. In "Lowa" slider resistances the resistance material is sandwiched between metal strips which form the contacts, thus helping to eliminate the wear which takes place where the contact bears directly on the wire. The resistance units are contained in a strong cast frame, the insulation being of mica throughout; they are compact, occupying small space, and the resistance material used is claimed to be impervious to climatic conditions and to moisture.

Messrs. Belling & Co., Montague Road, Edmonton, London, N. 18, show a selection of electric cooking, heating, and cleaning appliances for domestic use, including fires, water heaters, sweepers, a washing machine, and table appliances as exhibited at other recent exhibitions.

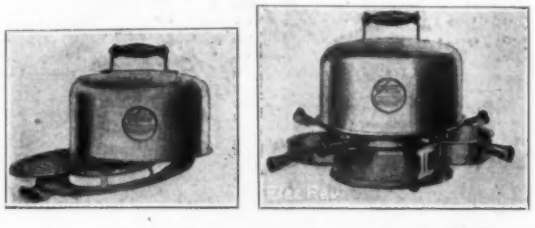
The British Electric Transformer Co., Ltd., 50, Oxford Street, London, W.1.—This stand takes the form of a model kitchen in which flame fires, ovens, boilers, grills, and other electrical "comforts" for the home are on view, some of which are seen in operation, and demonstrations are given at frequent intervals.

Quead, Ltd., 47, Marylebone Lane, Oxford Street, London, W. 1.—This exhibit takes the form of a selection of electric fires, and includes period style sheet metal fires which are seen in operation for the first time, and which can be supplied to match any period of decoration. A table cooker combination is also on view for the first time, and the firm's electric iron is efficient, having a consumption of only 475 watts for a full size iron on full heat. A feature is the provision of means for regulating the heat whereby full or half heat can be used for heating up quickly, and then a good ironing temperature maintained by cutting down the current so that only one quarter is used, hence its name, "Quarter heat" iron. The handle is of the "always cool" type, and a special rest is fitted on which the iron can be stood end up, thus avoiding the necessity of a special stand. The consumption of the firm's 12-in. fans at maximum speed does not exceed 36 watts; the construction is robust, and the guard is so designed as to avoid the rattling common to so many. The Quead electric soldering iron consumes 100 watts for every hot point; a substantial sheath protects the element which is practically air tight, thus helping to reduce heat loss and to prolong its life. The cable is connected in such a manner that should the iron be dropped there is no sudden pull on the leads, and close contact is effected between the element and the bit. The simplicity of construction renders replacement an easy matter.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, London, S.E. 18, exhibit the "Stannos" system of wiring buildings for electric light and power, features of which are low cost and the possibility of installation with minimum disturbance to the fabric and interior decoration of the building. Further particulars of the system will be found on another page of this issue in an article on electricity in small dwellings.

Messrs. Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C. 4.—This exhibit takes the form of electrically lighting two portions of rooms completely on the "Kaleeco" system of wiring, also referred to in the article mentioned above, and shows the suitability of the wire and accessories for efficiently, yet unobtrusively, wiring on the surface, different classes of houses. The system consists of a circular metal sheathed single and flat metal sheathed multicore insulated wires, simple junction boxes provided with efficient bonding clamps, wall clips, continuity bar, and earth clip. It is neat, easy to erect, and very inexpensive. The conductors consist of tinned high-conductivity copper wires, insulated with two layers of vulcanised india-rubber taped with proofed tape, the whole vulcanised into a homogeneous body. The multicore wires have the cores laid side by side, the distinctive coloured proofed tapes ensuring easy tracing, and sheathed under heavy hydraulic pressure with a strong tube of metal forming a flattened section. The metallic sheathing, although stiff enough to prevent sagging between the fixing clips properly spaced, is easily bent round cornices. The junction box consists of a backplate and cover of tinned brass, inside which the wires are joined together as required by means of porcelain sheathed connectors. The backplate is slotted on site to any arrangement of wires called for, two slots being cut at each wire entry, leaving a tongue to which the metal sheathed wire is clamped by means of the bonding clamp which embraces wire and tongue, and is tightened up by a screw and nut. When the backplate has been fixed to the wall or other support and the internal connections have been made, the cover is marked and cut to fit over each bonding clamp. It is secured by small lugs, provided on the backplate, which pass through suitable openings in the cover and are bent over, no screws or nuts being used for this purpose. Efficient electrical continuity of the metallic sheathing throughout the installation together with reliable earthing, are secured by use of the complete range of "Kaleeco" accessories. Decorative wires braided with silk or glace cotton and accessories enamelled to match—when fixed on the surface, blend with existing decorations, and are practically unnoticeable. The system calls for no special switches, ceiling roses, fuseboards, or fixing blocks, all of which may be chosen to suit the architectural features of the building and the taste of the client.

Messrs L. G. Hawkins & Co., 116, Charing Cross Road, London, W.C.2, exhibit a comprehensive display of domestic electrical appliances, ranging from heating pads to electric washers and vacuum cleaners. The "Universal" vacuum cleaner is a very efficient sample of its type. The carpet sweeping portion consists of a spiral brush which takes up the dust into the vacuum chamber. The irons exhibited are arranged with a heating element fixed between two plates which exclude air, and give the iron heat-storing capacity. These irons are rested, when not in use, on a spring stand which isolates the iron from the table, preventing burning. The "tourist's" iron can be inverted and used as a stove; it also has a hole in one end into which curling irons can be slipped. Another very useful piece of domestic equipment is the portable single range, figs. 13 and 14, which consists of a double-shell oven, a single heating element arranged in three concentric circles, and other utensils. It is claimed that, with the aid of this range, meals can be cooked for two or three



Figs. 13 and 14.—Portable Single Range Ovens.

persons. An all-metal immersion heater is another exhibit. This is quite a small appliance, designed for boiling small quantities of liquid in a short time. A fusible plug to protect the heating element can be supplied with all appliances, and a special connector plug is included with almost all the heating apparatus. The coffee urns and hot-water kettles are of high artistic merit—a pleasant change from the usual rigid lines. The "Geyser" electric washer and ringer employs the unique high-speed propeller principle of washing. A powerful circulation of hot suds is driven through the clothes by means of a propeller in the bottom of the tank, and the water is drawn back through the clothes by suction. There is no wear on the clothes, they remain always under hot water in a perforated zinc cylinder kept constantly revolving by means of the propeller. The tank is all metal, and the steel frame is electrically welded. The zinc cylinder, and the inside of the galvanised steel tank are both copper plated, and then nickel plated, as a protection against rust and corrosion. The electric ringer is reversible, and has a positive safety release, and can be used at the same time as the washer or independently.

Amongst the other exhibits of electrical interest the Bastian Electric Co., Ltd., show electric fires of various types and water heating apparatus. The Falkirk Iron Co., Ltd., exhibits radiators and cooking ranges, while Messrs. Boulton & Paul, Ltd., have on view a complete generating plant for country house use, comprising a paraffin engine direct coupled to a generator which is capable of lighting 75 20-watt 16-c.p. lamps or the equivalent. The stand of the Rawlplug Co., Ltd., whose products should be of considerable utility in the home, attracts well-deserved attention. In the labour-saving section, which finds accommodation in the gallery, Mr. G. E. W. Crowe has an interesting exhibit of electrical heating and cooking appliances, all of which goods are made in Canada.

Mr. R. B. Stewart demonstrates "Time Saver" electric washing machines, while the "Modern Home" washers and wringers are shown by the Pneuvac Co., Ltd. Wallach Bros., Ltd., demonstrate the merits of vacuum cleaners, as does also the Hoover Suction Sweeper Co., Ltd. Electrically-heated mats, muffs, travelling pads, therapeutic bandages, and other similar articles are on view at the stand of M. E. du Bois & Co. These useful devices are fitted with a "regulator," enabling the temperature to be varied to suit requirements, and also with a "resistance plug," to enable them to be used at any pressure from 100 to 250 volts. Other electrical appliances for the home are on view at the stands of Messrs. Benham & Sons, Ltd., Magic Appliances, Ltd., Duncan Watson & Co., Chas. E. Beck & Co., Ltd., S. G. Leach & Co., Ltd., and the Electric Appliances Co., Ltd.

The Exhibition, which closes on February 25th, has proved a popular success; it was visited on Tuesday morning last by T.M. the King and Queen.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

University Training.

Mr. G. W. Roffe's letter raises a point which a number of men who are endeavouring to strive upwards would be pleased to see discussed in your columns—the value of technical education by correspondence. As one who has had a few years of it, I consider it fills a long-felt want, namely, to give technical education during practical work.

We are told that the best workman is the one who is interested in, and who studies his work. But do employers take this view?

My experience in seeking employment is gradually forcing me to the conclusion that a man who can only do one kind of job, and that almost automatically from constant repetition, is considered before an all-round man.

I agree that specialisation is necessary. But my experience in charge of different shops teaches me that a good all-round man who has studied his work can conquer quite a number of jobs quickly. Employers in their demand for specialisation seem to miss this point. I am not suggesting that capital should train labour. In these days of "returned heroes" surely employers might at least consider the applications for employment of those who show they are "striving upwards," even if only by correspondence tuition.

G. Nicholson.

London, E. 6.
February 13th, 1920.

Projector Lamps.

Re your correspondent's inquiry concerning projector lamps, the following particulars may help him. The lamp which takes the place of the arc is the Mazda C incandescent, which has a filament consisting of four parallel helical coils, side by side in the same vertical plane, and about half their diameter apart. A mirror behind the lamp reflects the light thrown backward so as to fill up the spaces between these coils, producing the equivalent of an intensely brilliant, solid filament. It is used professionally in the States, where the current is alternating; where D.C. is the supply, the usual arc is reckoned best. The lamp is used with the usual condenser system, and is made in two wattages, 600 and 900. Its average life is about 100 hours, and it operates at about 30 volts. The makers of the complete equipment are The Precision Machine Co., Inc., New York, U.S.A.

F. G. Humberstone,
Chief Operator-electrician, "A.W." Circuit.

Weymouth.
February 16th, 1920.

The I.E.E. Council and the Territorial Centres.

Into the general question of leaks I will not enter, but since a leaky argument is one which will not hold water, I must say a word in reply to your editorial comment on the reason I gave at Liverpool for not swamping elected members of Council of the I.E.E. with chairmen of Centres. In the first place, the articles clearly contemplate that fundamentally the Institution shall be ruled by members of Council elected by ballot by the whole body of members from the country. Secondly, chairmen of Centres are usually, and properly, chosen for personal reasons of local suitability, irrespective of the branch of the profession they represent, whereas the ordinary members of Council should be, and are, as far as possible, representative of all branches. Thirdly, the number of members attached to the various Centres differs greatly, and therefore individual members of small Centres would have an undue proportion of representation on the Council. Fourthly, the change in personnel of the Council each year would be too great, since the chairman of a Centre only has a seat on the Council for two years instead of the three years of an ordinary member of Council. Lastly, there is the "more plausible objection" you advance. May I emphasise the fact so ably put forward at Liverpool by the president that the Council must be supreme, and stands on a totally different footing from a Territorial Centre Committee. There might be much to be said for a London Centre, but the work of its committee would be confined to local administration in connection with London meetings, and the London Centre would have to be just as much subordinated to the Council as the other Centres. The work of the Council differs radically from that of local committees, and the two do not admit of comparison. In conclusion, may I point out that Mr. Robertson's remarks about Students' papers were based on a misapprehension; no distinction is made in the publication of such papers between those of London and provincial Students.

C. H. Wordingham.

London, S.W.
February 16th, 1920.

Electrolytic Meters.

In reply to the letter from "H. W. M.," my statement that electrolytic meters are not used to any great extent was based on personal observation, and I am quite willing to withdraw it if satisfactory statistics to the contrary are produced. It would be interesting to have authentic figures as to the actual numbers of meters of the electrolytic and motor type at present in use in Great Britain. I do not agree with "H. W. M." regarding the size of meter which is desirable. The increasing use of electrical domestic appliances, radiators, &c., tends to justify the 5-ampere size as compared with the 2-ampere one. Concentration on a 5-ampere model would, I think, more than justify the very small amount of extra material needed, and would result in a cheaper meter. "H. W. M." evidently thinks it impossible for the motor meter to compete with the electrolytic meter on a price standpoint; that is, of course, merely a statement of his own opinion.

Referring to the letter of the Bastian Meter Co., Ltd., as will be seen from my reply to "H. W. M.," I intended to convey the impression that the electrolytic meter is used to a *relatively* small extent. If Mr. Salisbury will publish figures as to the production of his type of meter, perhaps the motor meter makers will put up theirs for comparison, and so give us a quantitative idea of the relative positions of the rival types. Mr. Salisbury's claims as to accuracy and simplicity are thoroughly justified, but it is questionable whether the filling and maintenance costs do not annul the advantage of low initial price. The satisfactory nature of his business is, however, sufficient criterion of the fact that many people share his opinion.

C. W. Marshall.

Carluke.
February 16th, 1920.

Officers' Association (Employment Bureau).

Now that the Ex-officers' Employment Bureau is moved from Dashwood House to Grosvenor Place, it has lost the services of some voluntary interviewers in the city who have done such excellent work for two years past. They must be replaced by Westminster men. Will any experienced business men, who are able to give their services for one or more mornings or afternoons per week, call or write to

J. A. Goudge,
Hon. Secretary,
Officers' Association (Employment Bureau).

32, Grosvenor Place, S.W. 1.
February 17th, 1920.

Awards Delayed.

A letter appeared in the Electrical Review of January 30th signed "W.O. Electrical Staff," which drew attention to the non-payment by the War Office of awards (granted by Government-appointed arbitrators) to civilian staffs employed in power stations under their control.

In connection with this it is interesting to note that, at a certain War Department power station, the staff, right from the beginning of the late war, have had the mortifying experience of seeing and hearing of other power station employés' salaries and wages advanced by leaps and bounds, in accordance with the ever-increasing cost of the necessities of life, while their own wages remained at the pre-war level, and to get an increase or bonus they had in some cases to resign, or threaten to resign their posts; in one case, having succeeded after great efforts in getting the increases when long overdue, back pay was not paid.

The result of all this has been that practically the whole of the staff have been compelled in their own interests to join some protective organisation, whereas previous to the war, not one of the staff in question belonged to any trade union.

At the present time the combined efforts of three trade unions have so far failed to get the latest 5s. award paid to

the men, although at a power station of a similar capacity, under the Air Ministry's control, this award was paid out last December. Neither has the 9281 award been granted to members of the staff to whom it applies, although due from March 31st, 1919.

This deliberate breeding of discontent amongst the staff concerned is bound to have a very detrimental effect on the loyalty of the staff, and on the working of things generally, is sure to find expression in one way or another, and is the result of the War Office not recognising the spirit of the "fair wages clause."

War Department Power Station Staff.

February 14th, 1920.

LEGAL.

Hull Prosecutions.

A sequel to the recent electricity shortage at Hull, and the first cases of the kind concerning the improper use of electricity, were heard at Hull Police Court when George H. King, tradesman, and George A. Lamb, secretary, were charged with unlawfully laying electric mains and connecting with mains belonging to the Corporation.

Major H. Bell, the city electrical engineer, in the course of the proceedings, pointed out that there were the most urgent reasons why these connections should not be made without the knowledge of the Corporation. There must be the fullest co-operation between the suppliers of the current and the consumers, or the results would be serious. If every consumer did as defendants the supply would have to stop.

In the case of King, he possessed a knowledge of electricity, and he utilised an overhead telephone wire from one of his shops to another to convey the current; it was explained that it was dangerous to use telephone wire for current for lighting because of the latter's high voltage.

In the other case, defendant fixed up a cable for outdoor lighting for his premises.

In both cases, it was pointed out, the current was registered through meters, and there was no question of the energy not having been paid for.

Each defendant was fined £2 2s.

Universal Radio Syndicate, Ltd. (in liquidation) v. Baxendale.

In the Commercial Court of King's Bench, on February 12th, Mr. Justice Roche heard an action in which plaintiffs claimed by their liquidator damages against their former managing director, Mr. Arthur Baxendale, in respect of an alleged breach of agreement, or in the alternative an account of profits made by him by work which he had undertaken in breach of his duty when employed by the syndicate.

Mr. Douglas Hogg, K.C., with whom was Mr. Raynor Goddard, appeared for the plaintiffs, and Mr. Compston, K.C., was for the defendant.

Mr. Douglas Hogg, in opening plaintiffs' case, said that the claim related to the erection of a Poulsen wireless installation at the Eiffel Tower by Mr. Baxendale in conjunction with Mr. Elwell, who was the managing engineer to the syndicate, the contract for which he had appropriated and used for his own benefit. The syndicate was formed with the object of exploiting the Poulsen system of wireless telegraphy in respect of which the syndicate held a licence, and Mr. Baxendale held the position of managing director under an agreement dated September, 1912. The syndicate set to work to make known the advantages of the system, and it was successful in obtaining contracts with the Government. It was desired to have an installation at the Eiffel Tower by which communication could be set up with America. In the early part of 1913 Mr. Baxendale was able to arrange with Mr. Husson in Paris for him to act for the syndicate in endeavouring to obtain authority to use the Eiffel Tower for trying the Poulsen system, and in March of that year he communicated with a French telegraph company interested in the installation of the wireless system, after which there was a long correspondence. At the end of December, 1914, the syndicate had failed to get sufficient capital to carry out their option to buy the Poulsen system, and on January 19th, 1915, they went into voluntary liquidation, and on January 21st Mr. Baxendale wrote a letter which modified his original agreement under which he was paid at the rate of £1,500 a year. He wanted a lump sum in settlement of his claim.

His Lordship: I did not know that he could remain a managing director after the liquidation, but he could remain a manager.

Mr. Douglas Hogg: On February 11th, 1915, he proposed that on payment of £500 to forgo his claim against the syndicate, and in consideration of that payment, he undertook to continue to give every assistance in the liquidation until the following September, and practically to give advice up to January 1st. There was reason to believe that at about that date a letter was written by Mr. Hussen to Mr. Baxendale, as managing director of the Radio Syndicate, regarding the Eiffel Tower contract, and other letters on the same subject were written to Mr. Elwell. At the end of March, 1915, Mr. Elwell went to France. The syndicate thought he had gone only in connection with arrangements for a holiday for his wife and not on business matters. On his return, however, he invited various companies to tender for different parts of the installation at the Eiffel Tower. When, in May, it was found out what was going on, Mr. Baxendale was spoken to. He (Mr. Baxendale) admitted that he had sent Mr. Elwell because he did not think the syndicate could carry out the contract. The correspondence showed that Mr. Elwell was acting for Mr. Baxendale, and that the contract for which they were negotiating was for £98,500 odd for an installation for purely military purposes. In November, 1915, litigation was commenced between Mr. Elwell and the syndicate in respect of his salary, and in 1917 Mr. Baxendale made efforts to stop Mr. Walrond (the liquidator) from proceeding against Mr. Elwell. Counsel then read correspondence for the purpose of showing that in 1914 and 1915 Mr. Baxendale was negotiating with the authorities in France, especially the military authorities, in view of the erection of the installation, and that in 1915 he sent Mr. Elwell out to France to try to get the contract for himself. Mr. Douglas Hogg submitted that under these circumstances Mr. Baxendale was liable in damages for breach of his duty to the syndicate.

At the conclusion of the plaintiffs' case, Mr. Compston submitted that there was no case for him to meet, as the documents did not reveal any implied terms with regard to the inability of Mr. Baxendale to carry on any business he liked so long as he to the best of his ability assisted the liquidator in winding up the syndicate's affairs. There was no engagement that he would not enter into competition with the company.

His Lordship said he was against counsel on that submission.

Mr. Compston argued that the liquidator could not legally carry on any fresh business during the winding up. He could not enter into any contracts except where they were necessary to enable the existing assets of the business to be disposed of to the best advantage.

Mr. Arthur Baxendale was called, and gave evidence as to what had taken place after the liquidation was decided upon, and the position taken up by the advisory committee. He said that the committee was opposed to taking up any new business. He had been absolutely ruined by the collapse of the business, in which he had put £1,200. He told his co-directors that he was going to work as hard as he could for the reconstruction of the company, but he was unable to bring it about. Up to the end of 1915, for a whole year, he was working with that object in view. The patents were nearing expiration, and had now expired, the station being worked by the Government. The first he heard about the French installation was in 1915.

His Lordship here interposed, and asked had any effort been made to arrange this matter.

Counsel intimated that there had been a proposal.

Mr. Baxendale: I understood that the whole point was to get my shares. I was asked if I was willing to sell, and I replied that I was unable to do so.

His Lordship, in giving judgment, said that the action was similar in nature to an action in which the present plaintiff and Mr. Elwell were concerned, which was tried some three months ago before him, and he then formed a view on the case which he still entertained in the present case. The defendant had entered into a contract on his own behalf, and must account to the company for any benefit he had received under that contract. He agreed that when the liquidation came into force the defendant was no longer bound by his contract of employment, but by an agreement he undertook to render advice and assist in the liquidation. He (the judge) was satisfied that the beneficial winding up of the company required that such a contract should be entered into. He was also satisfied that the company could have got the contract with the French Government. The defendant did not offer this contract to the company, but, in fact, went behind the back of the company, first, because he mistook his rights, and then because his feelings led him away. He was in conflict with the advisory committee, and therefore secretly arranged with the French Government for business which might have become of considerable value. He had undertaken to assist the liquidator as representing the existing company, not a company to be reconstructed, and he did something detrimental to the liquidation. He (his Lordship) held that there was an implied obligation not to do anything of the sort. He was still connected with the syndicate in liquidation, and his position enabled him to get the contract. The plaintiff had a right to the account for which he asked, but he was satisfied that so far as money was concerned there was not any large sum to come from the contract. On the whole it seemed to him that an account should be taken if the parties could not agree. Something ought to be done to put an end to these matters. His judgment was for the plaintiff with costs of the action for an account.

Mr. Douglas Hogg said he was prepared to take judgment for £200 and so avoid further proceedings.

Mr. Compston asked that judgment might be suspended as to taking an account until he had had time to consider the question.

His Lordship said he was willing to do that on payment of the costs.

BUSINESS NOTES.

Industrial Electric Supply Council for the North-East Coast.—At a conference in Newcastle-on-Tyne on 10th inst., held under the presidency of the Lord Mayor (Mr. Walter Lee), it was decided to set up a District Council under the National Joint Industrial Council for the electricity supply industry for the North-East Coast, which will include Northumberland, Durham, and the Cleveland district of Yorkshire.

Catalogues and Lists.—Automatic and Electric Furnaces, Ltd., 281-283, Gray's Inn Road, W.C.1.—Pamphlet No. 18, "The Magnetic Sclerometer," describing experiments in steel-hardening, and a reprint from the *Colliery Guardian* dealing with Wild-Barfield electric furnaces.

Sterling Telephone and Electric Co., Ltd, Telephone House, 210-212, Tottenham Court Road, W.1.—Publications Nos. 270 to 275 inclusive. These pamphlets deal with (taking them in numerical order):—Electric shaft signals, mining telephones, "Ferro-Case" telephones, bells, and buzzers, indicators (bell, &c.), and accumulators. Fully priced and illustrated.

The Empire Roller Bearings Co., Ltd., 13, Victoria Street, S.W.1.—"Preliminary catalogue" (14 pp.) of roller bearings for use in various situations, including shaft bearings and axle boxes. Illustrated.

The Hoover Suction Sweeper Co, Ltd., Walmar House, 288-292, Regent Street, W.1.—"Cleanliness" (27 pp.), a well illustrated and neatly produced booklet recording the evolution of the vacuum sweeper and cleaner. The "Hoover" suction sweeper is illustrated in detail, and photographed in action. Also a fac-simile of the certificate of the Institute of Hygiene awarded to the company.

Mr. H. W. Sullivan, 368 and 369, Winchester House, E.C. 2.—List "W" 1,920, 24 pp., "Standard Condensers and Wireless Apparatus." An illustrated and priced catalogue of condensers, small transformers, rheostats, valves, &c., for "wireless" work.

Trade Announcements.—As briefly announced here last week, an amalgamation of interests has been effected between the Electrical Apparatus Co., Ltd., and Messrs. Bray. Markham and Reiss, Ltd. Both are specialists in the manufacture of motor-control gear—the former having a complete line of gear for industrial purposes and the latter having specialised more particularly on Admiralty-type apparatus during the war. The joint enterprise will be run under the ægis of the E.A.C., but the technical management of the B.M.R. Works will continue as in the past, under the expert guidance of Mr. E. N. Bray. It is hoped that the increased resources of the combination will result in greater efficiency all round.

Messrs. Fuller's United Electaic Works, Ltd., have transferred their sales department from Chadwell Heath to Iddesleigh House, Caxton Street Westminster, in order to cope with increased business. Telephone number: "Victoria 6863-4"; telegrams: "Bloobat Vic., London." The company will shortly open a showroom on the new premises for the exhibition of their products.

The L.P.S. Electrical Co. have removed their offices and stores to L.P.S. Works, Avenue Road, Acton, W. 3. Telephone: "Chiswick 1920" (two lines); telegrams: "Engineyor Act, London."

Mr. Stanley Carr has opened offices at 2 and 3, Red Lion Court, Fleet Street, E.C. 4, as the Telephone Maintenance Co. He has been associated with the telephone trade for 25 years, and will carry out all descriptions of telephone work.

The Electrical Engineering and Development, Ltd., has commenced business at 82, Victoria Street, S.W. It has been formed, with Mr. E. Schattner as managing director, for the purpose of developing and placing electrical inventions on the market, for sale of patents, acquisition of foreign electrical patents, and the development of export trade by arranging agency agreements. It is stated that an electrical testing department for inventions is being equipped, and engineers have been appointed as representatives in the principal industrial countries.

Strikes.—During the past week there has been a strike of nearly 1,500 employés of the Pirelli-General Cable Works, Ltd., at Southampton. *The Times* reports that the grievance was that the employés were not receiving the standard rates of wages as paid by other cable-making firms. The version given by the *Daily Herald* is as follows:—The Unions involved are the National Federation of Women Workers and the Electrical Trades Union. A fortnight ago representatives of the E.T.U. and the Federation met the employers on a question of wages. The meeting was adjourned until Tuesday of last week. On that day the employers, however, refused to negotiate with the E.T.U. on the ground that it did not represent the men. The reply of the E.T.U. and the Federation was to dispatch telegrams to the shop stewards, and within five minutes the whole works had stopped. The *Daily Herald* stated that instructions were understood to have been sent out to members of the E.T.U. all over the country not to use the wires or cables produced by Messrs. Pirelli.

A Sheffield paper reports that 100 employés of the D.B. Battery Co., Ltd., came out on strike on Tuesday morning.

Copper and Lead Prices.—Messrs. F. Smith & Co. report:—February 17th: Copper (electrolytic) bars, £130, £2 decrease; ditto sheets, no change; ditto wire rods, £145, £2 decrease; ditto H.C. wire, 1s. 5½d., ¼d. decrease; silicium bronze wire, 1s. 11¼d., ¼d. decrease.

Messrs. James & Shakespeare report:—February 17th: Copper bars (best selected), sheets and rod, £173, £2 increase; English pig lead, £54 10s., £4 increase.

Trade with Greece.—Credit Facilities. — Some facility with regard to the opening of credits abroad for payment of goods to be imported into Greece has been afforded by the following Government regulation:—

Merchants able to produce a certificate from the Financial Inspector of their district proving that they have been recognised as engaged in business for the period of two years up to date, are no longer called upon to deposit guarantee in cash. In lieu, thereof, the Government accept the merchant's personal guarantee for 40 per cent. of the value of the credit opened.

Commercial circles in Greece have welcomed this innovation, and hope that still greater facilities will shortly be granted to importers from foreign countries.

Lead.—In their report for February 14th, Messrs. James Forster & Co. state:—

As far as supplies are concerned, the future is full of gravity. There is no indication from Australia of the opening of the Broken Hill Mines which have now been shut down for nine months. From Spain we can expect very short supplies. The Penarroya Co., producing three-fourths or more of the total output of that country, has disposed of the whole of its production for this year on the Continent, and for months past this well-known brand has been practically absorbed in France. From Mexico or America we cannot hope to make up the shortage or anywhere approaching it. General consumers are not active, but still consumption increases, and must increase. The electrical cables and accumulator trades are very busy, and the outlook is towards an enormous expansion. Export trade is getting much too big to be encouraged in view of supplies.

Messrs. G. Cawson & Co. report:—

As we have so frequently pointed out, there are ample supplies of lead available—so long, however, as speculators continue to buy forward lead at extreme figures, the price of prompt metal seems of little importance to them. Some figures have recently been published, calculating that there may be a short supply of lead later in the year. All figures at present are most misleading. Apart from the Government stocks, there is a large quantity in store held privately and further quantities will probably be stored to help to sustain the market. Arrivals this week have been fairly heavy, but exports are trifling. A great point is made of the falling off in Australia, the fact being that Australia is still producing 80,000 to 100,000 tons of lead per annum, so that with available stocks we are sure of getting regular shipments. America remains more or less out of the market, except for bonded Mexican lead. The outlook is no clearer; we still maintain that present prices are far too high, and not justified by the position. There is no disguising the fact that so long as speculators continue to buy and force up prices, consumers must follow and pay up when necessary to cover their requirements.

Liverpool Electrical Dispute.—Our Liverpool correspondent says that Mr. L. G. Tate, the general secretary of the National Federated Electrical Association, has issued a circular appealing to members to make a levy of 5s. per cent. of the total wages paid during the last financial year, stating the reason as follows:—In the Liverpool area the Electrical Trades Union have asked for wide concessions, such as 4s. 6d. per day country allowance, overtime at the rate of time and a half for the first four hours, and then double time, dirt money, danger money, payment for meal times when working night shifts, &c. The circular goes on to state that if these payments are given in Liverpool they will be enforced in other parts of the country. The result has been a complete withdrawal of labour, and Liverpool members were asking what the N.F.E.A. were willing to do if they remained loyal to the Association. There is thus every prospect of a protracted dispute for which a settlement must sooner or later be found. Whether the representatives of the N.F.E.A. on the District Joint Industrial Council were empowered to agree to the new terms or not, it is evident that there have been misunderstandings, and it would appear to the writer a much more wise and saner course to pursue conciliatory methods, instead of hoping for a lasting settlement by the assertion of either side's ability to hold on.

Book Notices.—The *Journal* of the Röntgen Society, Vol. XVI, No. 62, January, 1920 (40 + xviii, pp.), 5s. net. London: Percy Lund, Humphries & Co., Ltd. The "Electrical Notes" review the most recent developments in radiology and kindred research work. Included in the *Journal* are interesting articles by Prof. W. H. Bragg, Dr. A. C. Jordan and other well-known scientists.

"Education and Training for the Electrical and Allied Engineering Industries." A report of the Education Committee of the British Electrical and Allied Manufacturers' Association. London: E. Arnold. Price 3s. 6d. net.

"*Bulletin* of the National Electric Light Association." Vol. VII, No. 1. January, 1920. 92 pp. New York: $3 per annum.—The first number of the new volume has been considerably enlarged and reconstructed. Among many other interesting features are remarkable photographs of electric lighting in New York and elsewhere.

A leaflet issued by Mr. R. Bowden, c/o Messrs. Elt & Co., 14, Bedford Row, W.C. 1, gives a brief summary of some important alterations in the law affecting British patents and designs.

"Wireless Telegraphy" (second edition). By W. H. Marchant, pp. ix + 294; 201 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d. net.

A.O.E.C. Meeting.—The annual general meeting of the Association of Officers and Staff Members of Electricity (Power and Supply) Companies of Great Britain, was held on Tuesday last, when the report of the Executive Committee was submitted. The report stated that Sir A. B. W. Kennedy had accepted the presidency, and pointed out that the new Clause 17 of the Electricity (Supply) Act, for the protection of employés, was practically identical with the proposals put forward on behalf of the Association. The accounts showed a credit balance of £183.

The Edlswan Staff Association.—This Association is carrying out an attractive programme of social events during the winter season at the Ponders End Works. One of these gatherings was held on the evening of Saturday, February 7th. About 100 members sat down to dinner in the staff café, Dr. C. E. Hiatt presiding. Subsequently a largely-attended concert was provided, Mr. F. H. Holyday officiating as musical director. The recently organised Pierrot Troupe, recruited from the ranks of the staff, made their initial bow to the public, and gave an extremely creditable performance of choruses, duets, solos and humorous interludes, the members of the troupe being: Mrs. Laughton, Miss Horne, Miss M. Warren, Miss N. Bourne, Miss Young, Miss M. Young, Miss E. Outten, Miss Walker, Messrs. H. G. Holyday, G. Tuffill, T. C. Black and E. C. Pembery. Other contributions to the programme were furnished by "Little Jack" and Mr. J. Moore.

Social Club at Enfield.—In connection with the Enfield Ediswan Cable Works Social Club, a successful inauguration social and dance was held on Saturday, February 7th, in the George Spicer schools, Enfield. The company was represented by the president, the Rt. Hon. Viscount Grimston, director, and the following vice-presidents: Mr. F. Plutte, managing director, Mr. A. V. Downton, technical director, and Mr. G. Heffernon, works manager. Various departmental managers, members of the staff, and 300 employés were present. Viscount Grimston, who presided, was given a very hearty reception. He said he regarded the club as a very happy step in the right direction for the promotion of good feeling and social development, and he expressed the opinion that the club could do much good; he wished it success. In referring to present day unrest, he said that we were in danger of becoming somewhat hidebound in our attitude towards present day problems, and tending to level down, and lose our sense of proportion, and wider vision. At the close of the first half of the musical programme Mr. Downton proposed a vote of thanks to Viscount Grimston and Mr. Plutte, and read letters of good wishes from Sir Ralph Ashton and Mr. J. Aspin, two other directors. Viscount Grimston responded. Dancing formed the second part of the programme. The evening was a very enjoyable one, thanks to the artists, the entertainment committee, and some members of the staff. Mr. Ernest Hupfeld is the club's enthusiastic secretary. A series of socials, whist drives, dances, &c., is contemplated.

All through a Calendar.—We hope we succeed in hiding the blushes as we publish the following communication received from the City Electrical Co., of 1, Emerald Street, W.C. In the ordinary course we only publish the correspondence which damns us for our faults, but in this instance we recognise that we are doing the reader, the firm interested, the trade as a whole, and incidentally our humble selves some slight service by giving expression in print to what so many have it in their hearts to say:—

"We thank you for your very courteous acknowledgment of our calendar in the columns of the REVIEW. How widely read and valued are your commendations is evidenced by the extraordinary number of applications we have received for copies. We should esteem it a great favour if you could find space to intimate to your readers that a second issue is being prepared, and all applications will be filled as speedily as may be. The result has convinced us of the value of the REVIEW as an advertising medium, and we have handed your advertising department a 52 insertion contract, the first of which we hope will appear in the current issue. We have purchased the Vulcan Works, Hoxton, which enables us to make the expansion that the great increase in our business has made necessary. Our stocks of new Motors, Dynamos, and Switchgear can now be considerably increased for the service of ELECTRICAL REVIEW readers."

Wages for London Kinema Operators.—The London and Home Counties branch of the Cinematograph Exhibitors' Association of Great Britain and Ireland and the E.T.U. have approved the following rates and conditions for their members employed in the Metropolitan area, *i.e.*, within a 15 miles radius of Charing Cross. There are two main classes, chief operators and second operators. The first class is to be paid the district rate of a journeyman electrician (at present 1s. 9½d. per hour) as a minimum, and chief operators in charge of producing plant the rate of a charge hand electrician (now 1s. 11½d. per hour). A chief operator is defined as one with four years' experience in the work. Second operators are to receive a miniumm of 1s. 3d. per hour—the necessary period for qualification being two years. Where the weekly takings of a theatre exceed £120, a chief operator must be employed, but otherwise a second operator may be engaged and paid 2d. per hour extra. Apprentices or probationers must be paid £1 per week for the first six months, rising to £2 for the fourth six months, after which period they become eligible for classification as second operators. Men and women are to be paid equal rates. The maximum working day will consist of 8 hours (Sundays 5 hours). Holidays are to be granted as follows: One week after six months' service, and two weeks after one year. These rates are to take effect as from December 1st, 1919.

Mazda Staff Concert.—A Mazda Bohemian concert was held on February 6th at the Falstaff Hotel, Eastcheap, E.C. An excellent programme of music was rendered, most of the artists being members of the Mazda House staff. The function, the first of its kind since the outbreak of war, was a reunion, the energetic organisers, captained by Mr. W. E. Bush, having brought together many former members of the staff. The chair was occupied by Mr. E. Coote, who, at the unanimous request of the audience, caused a message of sympathy to be sent to Mrs. Willcox, accompanied by earnest wishes for the speedy recovery of Mr. F. W. Willcox, the general manager of Mazda House, who, we regret to learn, has been seriously ill for some weeks.

Whitley Councils for Electricity Supply.—A meeting of the No. 6 District Joint Industrial Council was held in Bristol on Monday, February 16th. Mr. H. Faraday Proctor, chairman, reported the completed list of the employers' representatives as follows:—Mr. H. Faraday Proctor, Alderman G. Pearson and Councillor A. E. Thomas, Bristol, Alderman Sir H. T. Hatt, Bath; Mr. W. J. Bache, Cheltenham; Mr. F. H. Corson, Gloucester; Mr. G. Charlton, Weston-super-Mare; Mr. A. B. Randall, Salisbury; Alderman G. H. Stevens, Swindon; Mr. H. Leather, Minehead; Councillor J. E. Kingsbury, Taunton; Mr. J. Eliot Mills, Keynsham. A return of the undertakings in the area which are paying the 5s. award was reported, also a return of the undertakings which have adopted the 47 and 48 hours' week. A levy to meet the expenses of the District Council was decided upon, an equal amount being required from the undertakings and from the Trade Unions.

Dissolutions and Liquidations.—REX ACCUMULATOR CO., LTD.—Winding up voluntarily. Liquidator, Mr. M. Leggett, Dashwood House, 9, New Broad Street, E.C. Meeting of creditors was called for Wednesday, February 18th.

HEYES & Co., electrical engineers, Douglas Side, Wigan.—Mr. W. A. Heyes and Mr. L. O. Heyes have dissolved partnership. Mr. W. A. Heyes will attend to debts and continue the business.

German Copper Prices.—A wireless message says that the German Raw Copper Association has increased its sale price by 372 marks to 8,877 marks the 2 cwt.—*Times*.

New Norwegian Electrical Company.—The Aktieselskab Nordiske Kabel og Traadfabriken has decided to raise its capital from 5,000,000 to 10,000,000 kroner.

Catalogues Wanted.—Mr. Edward Birin, Latvian Consul in London, asks for catalogues of electrical machinery and lighting accessories to be sent to him at 4, Draper's Gardens, Throgmorton Avenue, E.C. 2.

The German Glow Lamp Trust.—The combination of wire lamp makers in Germany, to which reference was recently made in this journal, has now been constituted by the formation of a partnership company under the title of the Osram Werke G.m.b.H., Kommandit Gesellschaft, Berlin. The company, which has an ordinary share capital of 1,000,000 marks and a partnership capital of 29,000,000 marks, incorporates the glow lamp works of the German Incandescent Gas Light (Auer) Co., the A.E.G., and the Siemens & Halske Co., and negotiations are proceeding with a view to the inclusion of other glow lamp makers in the country. Mortgage bonds for 30,000,000 marks, and of the 4½ per cent. type, redeemable at 102 per cent., have been issued, and will shortly be offered by a banking syndicate for subscription. The parent companies are all represented on the board of directors, to which a delegate of the National Bank also belongs.

British Trade with Turkey.—We welcome, after between five and six years' suspension, the *Journal* of the British Chamber of Commerce of Turkey and the Balkan States. It makes its re-appearance, the first number since August, 1914, as a monthly Trade journal issued from Constantinople, under date January, 1920. We tender to the organisation our good wishes for uninterrupted and useful service in the interests of British trade. The opening notes, headed "In Memoriam," include a list of the Englishmen in the British community in Constantinople who served in the war and made the great sacrifice. A general survey of the trade situation follows. It goes without saying that the economic and financial situation in Turkey is critical. There is great congestion of goods at Constantinople, some intended for Turkey, and more for South Russia. There is a full list of members of the Chamber, and a good deal of general business information.

Auction Sale.—By direction of the Disposal Board, Ministry of Munitions, MESSRS. HARRIS & GILLOW will sell by auction at Shoreham Camp, Sussex, on March 3rd and 4th, the camp buildings, building material, &c., and a quantity of electrical appliances, &c., including switches, meters, pendants, switchboards, &c.

THE ASSETS AUCTIONS CO. will sell by auction, on February 25th, at Newington Causeway, several tons of brass rod and large quantities of brass terminals, copper plates, lampholders, &c. For full particulars see our advertisement pages to-day.

French Profit-Sharing Proposal.—The *Economic Review* quotes *Petit Marseillais*, stating that according to the Bill submitted to the French Chamber seeking to make compulsory the participation of employés and salaried persons in their employer's profits, the employer should dispose of at least 15 per cent. of his net profits in this manner: 10 per cent. should be divided among the employés in proportion to their average salary for the year; the remaining 5 per cent. should be placed to a regional union fund with the object of distributing the profits equally among employés and workers of the same vocation once a year.

LIGHTING AND POWER NOTES.

Aberdeen.—New Sub-Stations.—Two new sub-stations are to be erected in King Street and Jamieson Quay. The Town Council is applying for increased borrowing powers to the extent of £145,000.

Alloa.—Price Increase.—The Town Council is increasing the present charges for electricity in the burgh by 20 per cent.

Ammanford.—Electricity Supply.—The proprietor of the supply system has offered to sell the undertaking to the Council for £15,000. Failing purchase, he intends to apply for power to increase charges by 100 per cent.

Bewdley.—Price Increase.—The Electric Light Co. has informed the Town Council that the price for electricity is to be increased to 7d. per unit as from last September.

Birstall.—Breakdown.—Considerable inconvenience and loss to business people were caused by a breakdown at the transformer house at the works of Messrs. Henry Longbottom and Co., through which the locality is supplied. The supply to Birstall was not resumed until the following day.

Blackburn.—New Station.—It is stated that the demands for supply from the new generating station now being erected at Whitebirk will completely absorb the output, and the question of additional plant is already under consideration.

Loan.—The Town Council is applying for sanction to borrow £130,000 to be expended chiefly in extension of the area of distribution.

Bootle.—Loan.—The Bootle Corporation is applying to the Ministry of Health for the loan of nearly £8,000 for the erection of new offices, workshops, and stores, at the Marsh Lane electricity works.

Chepstow.—Tidal Power.—The construction of dams to enable the rise and fall of the tide to be utilised for the generation of electricity, is being considered. The rise of the tide at Chepstow is stated to be the second largest in the world—40 ft.

Chorley Wood.—Time Extension.—The Urban District Council has protested against the continued extension of time for laying distributing mains under the Rickmansworth and Chorley Wood Electric Lighting Order. A further six months has been granted from January 31st last.

Crieff.—Town Lighting.—An expert has been called in by the Council to report upon the cost and practicability of the installation of a lighting scheme, &c.

Dewsbury.—Loan.—The Town Council proposes to apply for a loan of £22,120—£8,500 for the purchase of the necessary plant in connection with a bulk supply from the Yorkshire Electric Power Co., and £13,620 for mains and distribution extensions.

Dundalk.—Inquiry into Prices.—The Council has received sanction to increase the maximum charge for lighting to 10d. per unit. The increase, however, is not yet being imposed, as it is stated that electricity for power is being sold at a loss, and consequently it would be inequitable to recoup the loss by an extra charge for lighting. A Committee has accordingly been appointed to investigate and report upon the subject.

Grantham.—Price Increases.—The Town Council has been notified by the Urban Electric Supply Co., Ltd., that charges for electricity will be advanced as follows, commencing from the December meter readings:—Power, first 100 units per quarter, 7d. per unit; next 3,000, 3½d.; and beyond, 2½d. Heating, first 100 units, 3½d.; and beyond, 2½d. per unit. The company is seeking to raise the maximum to 1s. 2d. per unit, and the Council is opposing.

Grimsby.—Loan.—The Town Council has decided to make application for an amount of £10,000 in addition to the loan of £100,000 already sanctioned. Consumers are to be charged 8s. per annum meter rent, payable in advance.

Kilkenny.—Lighting Scheme.—Applications from consulting engineers are being invited in connection with the formulation of a lighting scheme for the town.

Kirkcaldy.—Supply Undertaking.—Although the demands for electricity exceed the output of the generating station, the Electricity Commissioners will not sanction extensions, and the Town Council is, therefore, contemplating taking a bulk supply from the Fife Electric Power Co., as an auxiliary to the town supply. The Commissioners, however, apparently desire the Council to dispose of its generating station, and receive a supply from the Fife Electric Power Co. only.

Littlehampton.—Town Lighting.—The Urban District Council has given consent to Mr. Prior, of Burgess Hill, to carry out an electric lighting scheme for the town by means of an overhead system.

Liverpool.—Committees.—The City Council has been considering a proposal to appoint separate committees to deal with matters concerning the electricity and tramway departments. At present the two undertakings are combined. An alternative suggestion is that the existing Committee should hold separate meetings for each department.

London.—Hackney.—The report of the Electricity and Finance Committee of the Borough Council for the year ended March 31st, 1919, gives the total income and expenditure as £115,883 and £67,805 respectively, leaving a gross balance of £48,078. The deduction of loan charges, insurance, and other expenses resulted in a net profit of £8,618. The figure for the previous period was £10,763.

Manchester.—Sewage Works.—The Rivers Committee recommends the substitution of electric power for the present steam plant at the Withington Sewage Works. The cost of the installation will be £3,500, and the annual working expenses £1,600, as against the present annual cost of £2,640.

Middlesbrough.—Extensions.—In accordance with the electrical engineer's recommendations, the Town Council has decided to apply for a loan of £69,000. This includes over £20,000 for extension of mains and distributors, £406 for boosters, and £6,000 for a rotary converter.

Plymouth.—Extensions.—The Town Council is applying for sanction to a loan of £54,000 for cable extensions.

Ramsgate.—Proposed Price Increase.—The local Electric Light Co. has submitted for the Council's consideration the draft of a Bill authorising the increase of the present maximum price (8d. per unit) to 1s. 2d. The Town Council will oppose this in conjunction with other public bodies.

Rathmines (Co. Dublin).—Loan.—An inquiry is being made into the circumstances attending the Council's application for power to borrow £10,000. This amount is required for the extension of the electricity undertaking, and to cover work already completed.

Stafford.—Extensions.—The Town Council is applying for sanction to borrow £2,000 for mains extensions, &c. Electricity for shop lighting is to be supplied at the charge of 5d. per unit, subject to a minimum of three lights per shop and a payment of 15s. for the installation of a time-switch.

Stretford.—Plant Purchase.—The Urban District Council has recently purchased the undertaking of the Trafford Power and Light Supply (1902), Ltd.

Sunderland.—Proposed Extensions.—Proposals for the extension of the electricity works, at a total cost of over £127,000, were submitted to the Corporation last week. Among the items put forward are two new boilers, coal-handling machinery, a cooling tower, switchgear, a rotary converter, and the erection of an additional sub-station. The engineer states that the additions will effect a considerable saving. The Electricity Committee asked for time to consider the scheme, and a special meeting is to be called to deal with the matter.

Swansea.—Finance.—The deputy borough treasurer on February 12th sought the approval of the Finance Committee for the utilisation of two sums of £8,000 and £3,000 out of the sinking fund of the electricity undertaking for capital purposes. He said there was a great advantage in applying moneys in this way, inasmuch as if they borrowed money they would have to pay considerably more than by this method. The Committee agreed to this proposal.

Tredegar.—Proposed Electricity Works.—A Parliamentary Bill is being promoted by the Urban District Council, which will enable it, *inter alia*, to erect a power station and commence a supply within two years. The maximum price is fixed at 8d. per unit, subject to an agreed minimum of 13s. 4d. per quarter.

Walkden.—Sub-Stations.—The Lancashire Electric Power Co. has erected a sub-station in Brackley Street in order to cope with increasing demands. Messrs. E. Lane & Sons, cotton manufacturers, have built a private sub-station.

Whitby.—Loan.—The U.D.C. has applied for a loan of £9,000 for electricity purposes, in addition to £21,000 previously sought.

Whitehaven.—Extensions.—The Town Council is applying for a further loan of £4,800, principally for the purpose of mains extensions.

TRAMWAY AND RAILWAY NOTES.

Ayr.—Extensions.—The Town Council has decided to double the track to Prestwick at an estimated cost of £14,400. £30,000 is to be spent on track renewals in the centre of the town.

Bradford.—Slipper Contract.—An invention of the tramway manager, Mr. R. H. Wilkinson, a double-jointed slipper contact, has recently been introduced on the Bradford cars.

Burnley.—Report on Accident.—On December 3rd last, one of the Corporation's cars was ascending the Briercliffe New Road hill, and at a point about 180 yards from the foot of the hill it commenced to run back, eventually overturning on a curve. Five persons were injured, but neither driver nor conductor was hurt. In his report upon this accident, Major G. L. Hall, R.E., states that, upon examination of the damaged car, he found that the

positive lead of one of the motors had been broken off, which must have resulted in a loss of power, rendering the driver's attempt to apply power by means of the "series notches" ineffectual. Major Hall blamed both driver and conductor for the accident. The former did not use his hand-brake properly, or the car could have been held back; and the latter did not have the track-brake near the rails, in accordance with instructions, as in his evidence he admitted that he had to give the wheel "about 15 three-quarter turns."

Chatham.—YEAR'S WORKING.—The accounts of the Chatham and District Light Railway Co. for the year ended December 31st, 1919, show a gross balance of £26,225, the total revenue and expenditure being £78,840 and £52,615 respectively. After the deduction of rents, interest, &c., the result was a net balance of £14,259.

Dublin.—EMPLOYES' WAGES.—The employés of the Dublin Tramways Co. have accepted the company's offer to increase the wages of men by 5s. a week and boys by 2s. 6d. a week, retrospective as from January 1st last.

Jamaica.—TRAMWAY STRIKE.—The Conciliation Board formed to deal with the tramway dispute has settled the matter by granting substantial increases to both motormen and conductors.

Lancashire.—RAILWAY ELECTRIFICATION.—Referring to the proposed electrical extensions on the Lancashire and Yorkshire Railway Co.'s line at the annual meeting of the shareholders, the chairman said the directors were satisfied with the results of the electrification of the line, and they now favoured an extension of the electrification between Manchester and Oldham, and on to Shaw and Royton. The proposed extension formed part of a complete scheme which was prepared some time ago. As to the suggestion that the line should be electrified as far as Rochdale, that would be considered when they had carried out the scheme as far as Royton, but nothing definite could be done at present.

Leyton.—OPPOSITION TO BILLS.—A meeting to decide the question of opposing the Tramway Bills of the London and Middlesex County Councils is being held on February 24th.

London.—Owing to the failure of a signal, delay was caused on the Piccadilly and Brompton tube on Wednesday last week. On the same day tramcars were held up in the Old Kent Road through a plough jamming.

Surplus stock at the tramcar depôts was disposed of by the London County Council for £11,840.

PARLIAMENTARY BILLS.—The Bills relating to tramway extensions deposited at the House of Commons by the London County Council and the Middlesex County Council have been referred to the Standing Orders Committee for its decision regarding non-compliance with the Standing Order, which stipulates that the consent of local authorities affected by such Bills must be first obtained.

WORKMEN'S FARES.—Referring to the proposed abolition of workmen's fares, Lord Ashfield recently stated that these were merely an old tradition—a form of charity—and wages should now be such as to permit the payment of full fares by the working classes.

HACKNEY.—The London County Council Finance Committee recommends that sanction be given to the Borough Council for the borrowing of £7,300 for the provision of electrically-propelled refuse vehicles and incidental expenses.

Plymouth.—EXTENSIONS.—Among recent proposals adopted by the Town Council were items of £28,000 for the provision of new cars, £30,000 for the establishment of a motor-omnibus service, and £5,000 for plant extensions.

Pontypridd.—EMPLOYES' WAGES.—The Council received a letter last week from the Tramwaymen's Union, asking that the wages of the employés should be brought up to at least the figure now being paid to labourers and scavengers. The engineer and manager (Mr. J. E. Teasdel) supported the suggested increase, but in view of the fact that the tramwaymen were represented on the Tramways Joint District Council, [recommended that any action taken should be a concerted one. He added that the wages at present amounted to £26,285 per annum, and the increase suggested would mean a further expenditure of £1,300. This, he thought, would involve a revision of the fares. The manager's recommendation as to concerted action was agreed to.

Prestwich.—OPPOSITION TO BILL.—On the ground that the Salford Corporation is not offering to contribute sufficient towards the maintenance of the roads it will use, the Prestwich and Whitefield District Councils, together with other authorities, have decided to formally oppose the Salford Bill by which it is sought (*inter alia*) to run motor-buses, and extend tramway routes in localities adjacent to the borough. The amount offered by the Salford Corporation is three-eighths of 1d. per car-mile.

Transport Workers' Wages.—Following the application for a wage increase for commercial road vehicle workers, it is reported that the National Transport Workers' Federation has applied for an increase for all tramway and omnibus workers, to bring the wages up to 44s. per week above pre-war rates. The case for the tramway workers will come before the Joint Industrial Council for the tramway industry on February 26th.

Yorkshire.—STORM DAMAGE.—During recent storms the overflowing of the river Aire flooded several tramway routes in the Calder Valley, and caused a great deal of damage. Overhead wires were also torn down.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—The Marconi Co. announces that ordinary telegrams, routed "*viâ* Marconi and Pacific," may be accepted on and from February 16th for Admiralty Island, Australia (including Flinders Island, King Island, and Woodlark Island), Bougainville Island, British New Guinea, Cook or Hervey Islands, Fanning Island, Fiji Islands, Marshall Islands, New Britain, New Hebrides, New Ireland, New Zealand, Norfolk Island, Ocean Island, Samoa, Solomon Islands, Tahiti and Tulagi. The charges for messages so addressed are 2d. less per word than the cable rates specified in Column 2 of the relative pages of the Post Office Guide. These messages may be handed in at Marconi House, Strand, W.C. 2, and 1A, Fenchurch Street, E.C.; or any post office in the United Kingdom.

Bolivia.—Four of the six new lines which are to be added to the telegraph system are now under construction. A wireless station has been installed at Cobija, with offices in Brazil, whereby the north-eastern part of the country is placed in direct communication with the other parts of the Republic.

Denmark.—The Conciliation Commissioner's mediation proposals have been rejected by the Danish telephone workers who remain on strike. It is stated that the proposals differed very slightly from the offers made by the companies.—*Economic Review.*

The strike came to an end during the week-end, the workers having failed to secure the big rise in wages which they demanded six weeks ago.

The Danish Budget for the financial year 1920-21 contains a proposal to construct new telegraph routes, including lines from Copenhagen to Hellerup, Gilleleje, Kallundborg, and Skodsburg.

High-Speed Wireless Transmission.—When, probably in the not very distant future, it has become the normal practice to receive wireless messages much in the same way as ordinary line telegraph messages are nowadays received—that is, in the form of paper-strip inked in the Morse code or printed in Roman character, or when it has also become customary to transfer a wireless message automatically and immediately to land-line instruments, and perform these operations at the same speeds as those now possible in line telegraphy—it will be interesting to have it on record that some of the pioneer work in these directions has been carried out by officers of the Royal Engineers and other workers attached to them. For some time experiments have been in progress at the Signals Experimental Establishment, at Woolwich Common, and it is now found to be quite practicable to handle traffic by wireless telegraphy at speeds of 100 words per minute, using the standard Post Office type of Wheatstone transmitter with punched tape for transmission and the standard Wheatstone inker for reception. It is obvious that a message which can be made to operate an inker, can also be employed to actuate a printer receiver of the Creed or other well-known type, or to operate a line transmitter, and so translate the wireless message direct on to land lines. The first practical tests of this method were carried out between Woolwich and Bedford in July, 1919, when a speed of 62 words a minute was reached. After other trials, with gradually improved instruments, a prolonged test was made between Woolwich and Weymouth, using quite moderate power. The apparatus was not tried at much over 100 words per minute, but perfect records were obtained at the following speeds:—2,017 words in 30 minutes; 901 words in 8 minutes; 379 words in 4 minutes. Those accustomed to handling wireless traffic will readily realise the value of being able thus to receive at speed on a standard inker, and will appreciate the value of this experimental work. It may be added that there would not appear to be very much difficulty from the electrical point of view in attaining very much higher speeds. The only limit is that set by the exigencies of mechanical design.

Iceland.—At the end of 1918 the telegraph and telephone systems comprised 1,402 miles of pole line, 4,139 miles of wire, 140 stations, 1,877 telephone instruments, and 12 telegraph installations. In Reykjavik there were 752 telephone subscribers; in Akureyri, 139; and in Vestmannaeyja, 79.

New Telephone Exchange.—A new public telephone exchange, called Broadway, was to be opened at Jupp Road, Stratford East, on Saturday. The exchange is a temporary one, designed to relieve the Stratford area, and will open with the transfer of 225 subscribers' lines from the exchange. Broadway will be the second new exchange opened since the new year for the relief of existing exchanges, the first being Latchmere, in the Battersea area. A third exchange, to be called Clerkenwell, is nearing completion.

Spain.—A Royal Decree was published on January 18th describing the measures to be adopted in Spain in respect of wireless telegraph and telephone installations. According to the *Board of Trade Journal*, permanent installations are still to be controlled by the Decree of February 8th, 1917, and temporary installations are permitted for a limited period under certain reservations stated in the new Decree, which may be inspected at the Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W. 1.

United States.—According to the report about to be issued showing the result of the census of telephones covering the year 1917, there are 53,234 separate telephone systems and lines, which operated 28,827,188 miles of wire in the United States, and connected 11,716,520 telephones, and 21,175 public exchanges. The

messages aggregated 21,845,722,335. Figured on the estimated population of the country in 1917, this gives 211 messages per annum to every man, woman, and child. The industry in 1917 gave employment to 262,629 persons, of whom over 65 per cent. were women. The sum paid out in salaries and wages amounted to $175,670,449. These employés operated plant and equipment valued at $1,492,329,015, which yielded operating and non-operating revenues of $391,499,531. The report discusses the development of the telephone industry, telephone equipment and traffic; offers interesting comparisons between the Bell and other systems, and between the telephone system as a whole and the telegraph system; and gives important financial statistics of the industry. The dominating part that the Bell system plays in the industry may be illustrated by the fact that of all the other systems reported, 96·1 per cent. reported annual incomes of less than $5,000. During the decade 1907-1917 wire mileage increased 129 per cent., the number of telephones 102·8 per cent., the number of messages 90·5 per cent. for systems having incomes of $5,000 or more. While the revenue has more than doubled during the decade, the expenses have increased at an even more rapid rate. Salaries and wages paid, advanced from 47·4 per cent. of the total expenses in 1912, to 54·2 per cent. in 1917. For systems reporting annual incomes of more than $5,000 in 1917, the average total revenue per telephone was $38.41, average net income per telephone $6.13, and average surplus per telephone $1.46. This report of the telephone industry is part of the "Census of Electrical Industries" which was taken in 1918, covering the operations of the fiscal year 1917.—*T. & T. Age.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Aberdare.—Urban District Council. Electricity and Tramways Department. Stores for 12 months, including cables, meters, joint boxes, electric lamps, &c. (February 6th.)

Australia.—MELBOURNE.—March 30th. City Council. 12,000 metal filament incandescent lamps. (February 6th.)

April 12th. City Council. Two 2,000-KW. rotary converters; H.T. switchgear, 6,600 V.; D.C. switchgear, 600 V. (January 30th.)

Bedford.—February 21st. Electricity Department. E.H.T. cable and transformers, E.H.T. switchgear. (February 6th.)

Belfast.—March 10th. Electricity Department. Stores, including meters, cables, electrical accessories, lamps, carbon brushes, &c. (See this issue.)

Belgium.—February 27th. Municipal authorities of Villers-le-Peuplier (Province of Liege) are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the district.

Bedwas (Mon.).—March 4th. Bedwas Navigation Colliery Co., Ltd. Six months' supply of stores, including electrical goods, &c. (February 6th.)

Belfast.—March 22nd. Electricity Department. Coal-handling plant. (See this issue.)

Bristol.—February 23rd. Electricity Department. One 2,000-KW., single-phase, 2,200-V. turbo-generator, complete with condenser and auxiliaries. (February 6th.)

Broughton (nr. Chester).—February 25th. Hawarden Union. Installation of electric light at the institution. The Clerk, Union Offices, Broughton, nr. Chester.

Chester-le-Street (Co. Durham).—March 3rd. Urban District Council. Underground mains and all equipment for lighting district by electricity. F. J. Gray, Clerk, Council Offices.

Doncaster.—March 2nd. Electricity Department. Two 3,000-KW., three-phase turbo-generators, with condensing plants. (See this issue.)

Dundee.—February 23rd. Town Council. Electric lighting work at City Hall Buildings. Mr. J. Thomson, City Architect, Municipal Offices.

Farnworth.—February 25th. Urban District Council. One 750-KW. rotary converter, transformer, switchgear and instruments, cables, &c. (February 13th.)

France.—March 5th. French State Railway authorities, 43, Rue de Rome, Paris. Tenders for an electric lighting and power installation at the new railway works at Sotteville Quatre-Mares, near Rouen.

Gillingham.—February 28th. Electric Light and Power Department. Two 700 to 800-B.H.P. combined Diesel engines and alternators. (See this issue.)

Hammersmith.—March 3rd. Electricity Committee. Stores for 12 months, including electric light sundries, insulated wire, meters, jointing compound, &c. (February 13th.)

Lincoln.—March 2nd. Electricity Department. One automatic battery, for St. Swithin's Power Station. (February 6th.)

London.—Great Central Railway. March 17th. Stores for 12 months, including electrical line construction, electrical apparatus, wires, cables, lamps, &c. Specifications from Mr. W. Williams, Stores Superintendent, G.C.R., Gorton, Manchester.

H.M. Office of Works. February 26th. 12 months' supply of fuseboards, switches, &c. Controller of Supplies, King Charles Street, Westminster, S.W. 1.

Madagascar.—TAMATAVE.—March 1st. Paris, Ministère des Colonies (Service Administratif Colonial). Construction of water and electric supply services in the City of Tamatave, including development of the Volobefalls, and supply of electrical machinery, &c.

Manchester.—February 24th. Tramways Committee. Permanent-way points, tongues and centres; tramway-type amp.-hour meters and general stores, including motor parts, resistances, lamps, cable, &c. J. M. McElroy, General Manager, 55, Piccadilly.

Merthyr Tydfil.—March 9th. Board of Guardians. Electrical fittings for six months. The Workhouse Master.

New Zealand.—DUNEDIN.—April 26th. The Imperial Trade Correspondent at Dunedin has forwarded a copy of the specifications and plans in connection with a call for tenders by the Dunedin City Council for (*a*) electric car bodies; (*b*) car trucks; and (*c*) car equipment. These documents may be consulted by British firms interested, at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, S.W. 1 (Room 49). Copies of the specifications and plans can be obtained from the Town Clerk, Dunedin, on payment of a fee of £1 (returnable as usual).

Salford.—February 23rd. Electricity Department. Two water-tube boilers, with stokers, mechanical-draught plant, &c. (February 13th.)

Uruguay.—February 27th. General Administration of the Electric Power Station of the State. 97,500 electric metal-filament lamps. A copy of the conditions can be seen at the Department of Overseas Trade in London.

The Post Office authorities have decided that public tenders shall be called for the construction of a new national system of telephones for the city and department of Montevideo.—*Review of the River Plate.*

CLOSED.

Bradford.—Tramways Committee:—

Power cables for new cars, at £60 per car.—English Electric Co., Ltd.

Electricity Committee:—

Induced-draught fan and accessories.—Musgrave & Co., Ltd.
Ten motors.—Electromotors, Ltd.
Steelwork at Valley Road Works.—Redpath, Brown & Co., Ltd.
Battery booster.—Mather & Platt, Ltd.
Two H.T. 300-ampere oil switches.—Metropolitan-Vickers Electrical Co., Ltd.
One electric industrial truck, with side-tipping body.—Electromobile (Leeds), Ltd.
Boiler mountings for three new boilers.—J. Hopkinson & Co., Ltd.
Two self-contained impelled draught stokers.—Underfeed Stoker Co., Ltd.

Grimsby.—Town Council. Accepted:—

Coal-handling plant at the electricity works, £3,688.—Herbert Morris, Ltd

Lowestoft.—Electricity Committee. Accepted:—

Induced-draught fan, £857.—Davidson & Co.
Air and exhaust pumps, &c., £1,786; pipework, &c., £500; feed-water purifier, £600.—Belliss & Morcom, Ltd.

Sheffield.—At its last meeting the City Council had before it a statement showing that the Electric Supply Committee had considered the report of the General Manager giving particulars of tenders which were referred back to the Committee at the January Council meeting on the protest raised by Councillor Graves at the absence of any details. The Committee report, says the *Sheffield Daily Telegraph*, that "in view of the fact that the Finance Consultative Committee, acting on an instruction of the Council, have under consideration, at the present time, a question as to what matter shall be printed on minutes for submission to the Council, the Committee did not deem it advisable to give full details of the tenders referred to. They wish to inform the Council, however, that the total amount involved in the acceptance of such tenders is £104,351 4s. 3d., and they reaffirm their previous decision to accept the tenders, and recommend that the Corporate Common Seal be affixed to the necessary contracts."

Sunderland.—Electricity Committee. Accepted:—

Ressoils, Ltd.—Transformer oil.
Ferguson, Pailin, Ltd.—H.T. switchgear.
Ferranti, Ltd.—Ampere meters.

London.—Stepney.—Electricity Supply Committee.—The Council, on December 10th, 1919, decided to advertise for tenders for the supply of a 5,000-kw. turbo-alternator, with condenser, accessories, and switchgear, but contractors were also invited to tender for the largest set which could be accommodated in the space available :—

Turbo-alternator, &c., for Limehouse Station.

Size of set.	Name of tenderer.	Price.	Delivery.	Remarks.
kw.		£		
5,000	Adamson, D. & Co. Ltd.	50,495*	Oct., 1920	—
,,	Ateliers de Construction Oerlikon.	48,775*†	13 mths	—
,,	B.T.H. Co., Ltd.	(a) 48,712* (b) 48,662 (c) 48,642	15 mths	(a) "Grice" air-filter. (b) "Sturtevant" air-filter. (c) "Davidsons" air-filter.
,,	Brush Elec. Eng. Co., Ltd.	49,677	Uncertain	—
,,	Cole, Marchent and Morley, Ltd.	14,900	Oct., 1920	For condensing plant only.
,,	English Electric Co., Ltd.	45,877	6 mths ex site	—
,,	Escher, Wyss & Co., S.A.	(a) 50,569 (b) 52,321†	11 mths ,,	(a) Oerlikon alternator. (b) Brown, Boveri alternator.
,,	Fraser & Chalmers (Prop. G.E. Co.)	47,567*	11 mths	—
,,	Hick, Hargreaves and Co., Ltd.	14,650	10 mths	For condensing plant only.
,,	Metropolitan-Vickers Elec. Co., Ltd.	49,647*	10 mths ex works	—
,,	Mirrlees Watson Co., Ltd.	16,960	Oct., 1920	For condensing plant only.
,,	Parsons, C. A., & Co., Ltd.	47,850	Uncertain	Set quoted for since "sold."
,,	Reyrolle & Co., Ltd.	(a) 9,027 (b) 9,733	Oct., 1920 ,,	(a) As per existing board. (b) For stronger tanks and double-breaking capacity of switches. For switchgear only.
,,	Richardsons, Westgarth, Ltd.	(a) 47,334* (b) 47,434	7 to 8 mths ex works	(a) Two-jet air-pump. (b) Rotary air-pump.
6,000	Parsons, C. A., & Co., Ltd.	54,450	10 mths	—
6,500	English Electric Co., Ltd.	47,999	10 mths ex site	—
10,000	Fraser & Chalmers ..	69,003*	11 mths	—
,,	Parsons, C. A , & Co., Ltd.	61,050	12 mths	—
10,000	Cole, Marchent and Morley, Ltd.	24,857	Oct., 1920	Condensing plant only.
,,	Escher, Wyss & Co....	(a) 79,204† (b) 82,634†	13 mths ,,	(a) Oerlikon alternator. (b) Brown, Boveri alternator. If with Mirrlees Watson ejector air pump, price reduced £915.
,,	Hick, Hargreaves and Co., Ltd.	25,850	10 mths	For condensing plant only.
,,	**Metropolitan-Vickers Elec, Co., Ltd.**	**72,156*** (Recommended)	12 mths ex works	For an extra £1,750 a reduction of ·3 lb. in steam consumption will be guaranteed.

† Price calculated at 19 fr. = £1 sterling. To vary with rate of exchange.

* Tenders marked thus were sent in incomplete, and have been completed by adding in the figures of other tenderers, which is an arrangement agreed between the members of the British Electrical and Allied Manufacturers' Association.

The Committee recommends that the tender of the Metropolitan-Vickers Electrical Co., Ltd., for a 10,000-kw. turbo-alternator be accepted at £72,156 plus an extra £1,750 in order to secure a guarantee of a reduction of ·3 lb. per unit in steam consumption from the figure set out in the main tender.

Two water-tube boilers (recom.) .. **£43,914 Babcock & Wilcox, Ltd.**

1½ miles of conduits, and 2½ miles of troughs and covers.

Sutton & Co. (recom.)	**£1,875**
Henley's Telegraph Works Co., Ltd.	2,078
Siemens Bros. & Co., Ltd...	2,104

House service cable.

Henley's Telegraph Works Co., Ltd. (recom.) ..	**£558**
B.I. & Helsby Cables	571
W. T. Glover & Co.	585

FORTHCOMING EVENTS.

Birmingham and District Electric Club.—Saturday, February 21st. At the Grand Hotel, Colmore Row. At 7 p.m. Paper on "Electric Vehicles," by Major R. V. C. Brook.

Liverpool Engineering Society.—Monday, February 23rd. At the University, Liverpool. At 6.30 p.m. Lecture on "Aviation: the Past, the Present, and the Future," by Major-General Sir Frederick Sykes.

British Industries Fairs.—Monday, February 23rd to Friday, March 5th. At the Crystal Palace and the Castle Bromwich Aerodrome, Birmingham.

Institution of Civil Engineers.—Tuesday, February 24th. At Gt. George Street, S.W. At 5.30 p.m. Ordinary meeting.

Royal Institution of Great Britain.—Tuesday, February 24th. At Albemarle Street, W. At 3 p.m. Lecture on "Magnetic Susceptibility," by Prof. E. Wilson.
Friday, February 27th. At 9 p.m. Lecture on "Problems of Lubrication," by Mr. W. B. Hardy, F.R.S.

Illuminating Engineering Society.—Tuesday, February 24th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Discussion on Lighting Conditions in Mines," to be opened by Dr. T. Lister Llewellyn.

Paisley Association of Electrical Engineers.—Wednesday, February 25th. At the Y.M.C.A., 25, High Street. At 7.30 p.m. Paper on "The Historical Development of the Design of Generators," by Mr. A. McCrorie.

Edinburgh Electrical Society.—Wednesday, February 25th. At the Philosophical Institution. At 7.30 p.m. Paper on "Electrical Projectors and some of their Uses," by Mr. A. Ogilvie.

Institution of Electrical Engineers.—Joint meeting with the Röntgen Society and the Electro-Therapeutic Section of the Royal Society of Medicine. Thursday, February 26th. At the Royal Society of Medicine, Wimpole Street. At 5.45 and 8.15 p.m. Papers on "The Efficiency of High-tension Transformers as used for X-Ray Purposes," by Dr. R. Morton; "The Problem of Interrupted and Fluctuating Currents," by Major C. E. S. Phillips; and "High-tension Transformers," by Mr. R. S. Wright.
(**North-Eastern Centre**).—Monday, February 23rd. At the Armstrong College, Newcastle. At 7.15 p.m. Lecture on "Some Magnetic Problems," by Mr. L. H. A. Carr.
(**North-Western Centre**).—Tuesday, February 24th. At the Engineers' Club. At 7 p.m. Informal discussion on "Electricity Supply Tariffs."
(**North Midland Centre.**)—Friday, February 27th. At the Queen's Hotel, Leeds. Annual dinner. Reception 6.30 p.m.; dinner 6.45 p.m.
(**South Midland Centre**).—Wednesday, February 25th. At the Library, Margaret Street, Birmingham. At 7.30 p.m. Paper on "Transformers for Electric Furnaces," by Mr. J. L. Thompson.

Junior Institution of Engineers.—Thursday, February 26th. At 6.00 p.m. Visit to the Works of the British Oxygen Co., Ltd., at East Greenwich.
Friday, February 27th. At 29, Victoria Street, S.W. Lecturette on "Defects Found on Inspection of Boilers," by Mr. R. H. Kenyon.

Wireless Society of London.—Friday, February 27th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Lecture on "Some Wireless Wonders," by Mr. Alan A. Campbell Swinton.

Association of Engineering and Shipbuilding Draughtsmen.—Thursday, February 27th. At 7.30 p.m. At the Engineering Lecture Theatre, Liverpool University. Lecture by Prof. E. W. Marchant, D.Sc., on "Wireless Telegraphy."

NOTES.

Another American Turbine Failure.—Damage to the extent of $100,000 was caused at the Regina, Sask., city power station on January 8th, says the *Engineer*, when the rotor of one of the large steam turbines burst and completely wrecked the set. As a result, the tramway system was temporarily at a standstill.

Electric Vehicle Progress.—The provision of plant for a charging station for electric vehicles for refuse collection has been considered by the Hackney Borough Council. The tenders for the motor-generator (250 amperes, 110 volts) included the following :—Lancashire Dynamo and Motor Co. (780 R.P.M.), £475, and (1,000 R.P.M.), £445; J. H. Holmes (900 R.P.M.), £445; Electromotors, Ltd. (710 R.P.M.), £432 12s.; British Thomson-Houston Co. (815 R.P.M.), £415; Electric Construction Co. (1,300 R.P.M.), £280 and (1,000 R.P.M.), £330. For the charging switchgear the quotations were :—Lancashire Dynamo and Motor Co. £629; J. H. Holmes, £480; and Igranic Electric Co., £433 10s. The Public Health Committee recommended the acceptance of the tender of the Electric Construction Co. for the supply of the motor-generator for £330, and of the Igranic Electric Co. for the provision of the charging switchgear for £433 10s. The first four electric vehicles will be supplied by Ransomes, Sims & Jefferies, the contract price being £5,118 for two 2-tonners and two 3½-tonners, fitted with side-tipping arrangements. The Harwich Town Council is applying for permission to borrow £3,000 for the purchase of two electric vehicles. The Works Committee of the Ilford Urban Council has recommended the acceptance of a tender by Ransomes, Sims & Jefferies, for the supply of six "Orwell" electric vehicles, required for refuse collection purposes. The London Metropolitan Asylums Board has entered into further agreements with the Tudor Accumulator Co. for the maintenance for a year of the electric batteries of two vehicles at a cost of 2½d. per mile run. The Pontypridd Urban Council is to obtain another Edison accumulator electric vehicle for the sanitary services.—*The Electric Vehicle.*

A large British engineering firm has definitely decided to take up the manufacture of electric battery vehicles. This development, which is important in itself, is also an indication of the trend of events in electric vehicle production. There is a very large unsatisfied demand for battery vehicles of all kinds, and existing makers are seriously preoccupied with the difficulties of delivery.

Searchlight Officers.—All officers who commanded searchlight sections in France are requested to send their names and addresses to Major A. W. Mawby, O.B.E., R.E., 47, Penywern Road, Earl's Court, S.W. 5. This request is not with a view to immediate re-mobilisation, but in order that he may furnish as complete a list as possible to Captain K. M. Locke, M.C., who is organising an annual dinner of all anti-aircraft officers, later in the year, at which searchlight officers will be welcome; and also to enable Major Mawby to keep a record for the purpose of a regular annual reunion dinner of Overseas Searchlight Officers. The first Overseas Searchlight Officers' Dinner, to which Major Mawby invited all with whom he was able to get in touch, was held at the Trocadero Restaurant on January 30th. The following were present:—Major T. Rich, O.B.E. (in the chair), Major Mawby, Captain Ffrench-Mullen, Captain A. W. Sproule, Messrs. L. C. Baldwin, Baumann, Bazalgette, Bodkin, Cox, Crosley, Done, Duckworth, Foulger, Hort, Myles, Raphael, Rawlings, Reed, Staunton, Wadham, K. L. Wood, and Voss. The speeches were of an informal character, and the gathering was a great success. Most of those present had not met one another since they had been in France, and many reminiscences were exchanged.

Direct United States Cable Co., Ltd., v. Western Union Telegraph Co., Ltd.—This action was before Mr. Justice Peterson in the Chancery Division on February 16th and 17th, and was adjourned until Monday next.

Freemasonry.—An emergency meeting of the Kelvin Lodge will be held at the Mark Masons Hall, Great Queen Street, London, W.C., on Friday, 27th inst., at 4.45 p.m. The secretary is Mr. H. W. S. Rentell, 36, Maiden Lane, W.C. 2. (Telephone: Gerrard 2460.)

Worse to Follow!—The following letter was reproduced in facsimile in the *E.T.Z.* of December 18th, under the heading, "The Reply of a 'Gentleman.'" An explanatory paragraph stated that the Dutch branch of the Siemens-Schuckert Co. had received a telegram from Bombay in August last year, of which the contents were not intelligible. It was thought that the message came from the Bombay representative of Siemens Brothers Dynamo Works, who was politely asked for enlightenment. After saying that the reply is characteristic of the culture and disposition of the writer, the *E.T.Z.* remarks that comment is unnecessary.

We fear the "Germhuns" will begin to think we don't like them, if they receive many more letters of this kind:—

Siemens Brothers Dynamo Works, Ltd.
Rampart Row, Bombay.
Siemens-Schuckertwerke 3—10—1919.
8, Gravenhage, Huygenspark 39 C.

We have received your letter No. 26 A R dated September 2nd, 1919. Your statement that we sent you a cablegram about August 24th last is a rotten lie—worthy of a Hun.

We do not know what the purpose of your letter is, but if it is an endeavour to start correspondence with us, with a view to business, we can tell you straight that during the writer's lifetime he will not touch anything German again, as it stinks, like your name.

We also do not want your friendly greetings—from Germhuns!

We do not want our customers to know that we have received letters from Germhuns, so do not write us again—if you do we will write you back a really nasty letter.

It is, of course, difficult to express in words what an ordinary decent-minded Britisher thinks of the German Huns, but you may be able to guess from the foregoing.

Siemens Bros. Dynamo Works, Ltd.,
(Signed) Geo. Barnes, *Manager*.

Appointments Vacant.—Telegraph inspectors (£200 + £65) for the Posts and Telegraphs Department in the Tanganyika Territory; executive engineer (£750) for the Nigerian Government Public Works Department; lectureship in electrical engineering for the Birmingham Municipal Technical School; draughtsman for the City of Leicester electricity department; electrician and electrical fitter for the Londonderry Corporation electricity department; charge engineer (90s.) for the Corporation of Stafford electricity department; switchboard attendant (37s. 6d. + 38s. 6d. + 12½ per cent.) for the City of Chester electricity department; sub-station attendant (82s. 8d.) for the Stoke Newington Borough Council electric light station; control engineer for the Yorkshire Electric Power Co.; mains assistant (£240) for the Borough of Aylesbury electricity department; shift engineer (£300 + £120) for the Electric Light Department of the Government of Nigeria. See our advertisement pages to-day.

Fatalities.—An inquiry was held at Bradford, last week, relative to the death of Thomas Beaumont, labourer, who was killed whilst manipulating an electric drill at the works of Messrs. Croft, Ltd., engineers, Empire Works, Thornbury, Bradford. The evidence showed that the man had been previously employed on similar work. Mr. Lewis Jessop, electrical engineer, Bradford, said, in his opinion, the flexible wire attached to the drill had been fractured, as the result of its having come into contact with, and been wound round the twist drill. The ends of the live wire and the casing of the drill coming into contact would cause the casing to become "alive." It would be safest for an earth wire to be attached when a portable drill of that kind was being used, but there was insufficient proof that even an earth wire would have prevented the accident. Verdict, "Accidental death."

At Wakefield, a verdict of "Death from misadventure" was returned at an inquest held on the body of a railway guard, named H. Riley, who was killed while on his way home from his work on the morning of January 29th, when a violent storm was raging. In going to the assistance of a fellow workman, who had got entangled in some telephone wires which had blown down, he himself also became entangled, and was killed through the wires coming into contact with the "live" tramway overhead wires. It was stated that at this particular point there were no guard wires over the trolley wires, and this was because the tramway company had been unable to procure a supply of guard wire. Before the war the tramway system of the Yorkshire (W.R.) Electric Tramways Co., Ltd., had been efficiently equipped with protective wires at all points.

An inquest was opened on 11th inst. into the death of Harold B. Hill, aged 30, an engineer, who was found dead with his hands badly burned, at the Islington electricity works at Upper Street. F. A. Jones, charge engineer, said that Hill relieved him at 11 p.m. on the previous Saturday. The medical evidence showed that both hands were burnt, and that there was a cleaning rag under deceased's thigh; there were blisters on the wrists and hands. Death was due to heart failure consequent upon shock. The inquiry was adjourned.

Oersted Centenary.—In honour of Oersted, the discoverer of electromagnetism, it is intended to hold an international centennial congress this year at Copenhagen, from August 31st to September 4th. In view of the many-sided influences of Oersted's discovery, the scope of the congress will be widened to include physics and chemistry, the congress being divided into three sections, represented as under:—Electrotechnical—Prof. P. O. Pedersen, chairman; Mr. Povl Vinding, engineer; and Mr. Aage Hassel, manufacturer. Physical—Prof. Dr. Martin Knudsen, chairman; Madame Dr. Kirstine Meyer; and Prof. K. Prytz. Chemical—Prof. Dr. S. P. L. Sorensen, chairman; Mr. Paul Bergsoe, engineer; and Prof. Dr. Einar Bellmann. The complete programme of the business of the congresses has not yet been drawn up. Prof. Dr. Martin Knudsen is the chairman of the Organising Committee.

Ships' Lights Committee.—The President of the Board of Trade has appointed a committee, under the chairmanship of Mr. Clifford C. Paterson, O.B.E., M.I.E.E., to consider the question of laying down standards for ships' lights to comply with the requirements of the International Collision Regulations.—*The Times.*

Educational.—Glasgow University has accepted an offer of £5,000 to establish a lectureship in electrical diagnosis and therapeutics at the Western Infirmary.—*The Times.*

INSTITUTION NOTES.

Institution of Electrical Engineers.—At the meeting last week, the President announced that the Council had decided to reimpose the condition, as from February 29th, that those seeking election as Associate Members must pass the Institution examination or one of the exempting examinations. In the case of a man being 35 years of age or over, the examination might be dispensed with, at the discretion of the Council. Another long list of candidates for election was approved; there were 215 names, including 54 Associate Members and 141 Students. This brings the membership up to 8,505.

Applications for tickets for the annual dinner at the Connaught Rooms, Great Queen Street, W.C., on March 4th, 1920, should be made to the Secretary of the Institution, No. 1, Albemarle Street, W. 1. not later than Saturday, February 28th.

Informal Meeting.—On Monday, Mr. A. B. Eason read a short lecture on "Automatic Telephony for Private Branch Exchanges," before a full attendance. Explaining that he was concerned only with private exchanges which were not connected to the public telephone system, the author briefly outlined the principles of working of the chief types of apparatus, and discussed their advantages in comparison with private manual exchanges and intercommunication telephone installations. At the conclusion of the lecture, leaflets giving many references to books, articles, and papers dealing with the subject of automatic telephony were distributed. A discussion followed, in the course of which many questions were put to, and answered by, the author. The chairman reminded the meeting of the "Informal Social Evening" to be held on March 29th.

North-Western Centre.—At the meeting held on February 10th, Lieut.-Colonel F. C. Aldous and Mr. A. E. L. Scanes delivered a lecture on the electric power supply in the Rhine Valley, a report of which will be published later.

South Midland Centre.—An interesting "full dress" debate on "The Uses of Gas and Electricity for Heating and Power," took place at the University of Birmingham on February 5th, and was attended by 350 gas and electrical engineers, industrial chemists, metallurgists and mechanical engineers. The occasion was a joint meeting of the Midland Junior Gas Association and the South Midland Centre of the Institution, and the chair was occupied by Mr. Councillor E. C. R. Marks, M.I.Mech.E. Very general interest was taken in the proceedings in gas and electrical engineering circles. A report of the proceedings will appear in a later number of the Electrical Review.

Scottish Centre.—It is reported that the sum of about £200—the surplus of the fund collected by the Institution and the Electrical Contractors' Association, for the formation of a signal company of the City of Glasgow Royal Engineers during the latter years of the war—has been handed over to the Benevolent Fund of the Institution.

Roentgen Society.—The "Silvanus Thompson Memorial" lecture will be delivered by Prof. W. H. Bragg, O.B.E., F.R.S., on March 2nd. The subject chosen is "Analysis by X-rays."

Institution of Engineers (India).—The offer of the I.E.E. (London) of a £20 premium annually for five years, to be awarded to the author of the best paper on an electrical subject read before the above new Institution, has been accepted. The Institution has taken temporary premises at D/5, Clive Buildings, Clive Street, Calcutta, where all communications should be addressed.

The Wireless Society of London.—The next meeting of this society will take place on Friday, February 27th, at 8 p.m., in the lecture hall of the Royal Society of Arts. The President, Mr. Alan A. Campbell Swinton, F.R.S., will deliver his address, the subject of which will be "Some Wireless Wonders." The address will be illustrated by experiments. In the afternoon of the same day a conference of Provincial Wireless Societies, which have recently become affiliated to the Wireless Society of London, will be held at 3 p.m., also at the Royal Society of Arts. Intending new members may apply for particulars of the Wireless Society of London, to the hon. secretary, Mr. L. McMichael, 32, Quex Road, West Hampstead, N.W. 6.

Edinburgh Electrical Society.—A lecture on "The History and Development of X-Ray Apparatus" was delivered by Mr. W. Law at the meeting on February 11th. The author dealt in a thorough manner with the evolution from the crude vacuum tubes first used,

to the highly efficient adjustable tubes now employed for examination and curative applications of X-rays. Various interrupters were illustrated, and their special qualities discussed in detail. Equipments of the portable and hospital types were shown. The next meeting will take place in the Philosophical Institute on February 25th, when Colonel Ogilvie will lecture on "Projectors."

Faraday House.—The annual dinner will in all probability be held during the second or third week of April, and in view of the large membership, now over 500, a record attendance of members and friends is expected.

Colonel Hubert Sparks, C.M.G., &c., M.I.E.E., M.I.Mech.E. (F.H. 1891-92), has been elected a Governor.

Diesel Engine Users' Association.—At the February meeting a considerable amount of interest was evinced in the discussion which took place after the reading of Mr. Geoffrey Porter's paper on "Wear of Diesel Engines." The author stated that liner wear was chiefly influenced by the percentage of ash content in the fuel oil and its variable nature according to the class of fuel used, the lubrication, the fit of pistons and piston rings, &c., and pointed to the deleterious effect of excessive cylinder lubrication, which resulted in the formation of carbon deposits on the piston. Mr. G. W. F. Horner, referring to the wear of fuel-pump plungers, stated that he had found no appreciable difference since using tar oil fuel as compared with petroleum. Mr. A. N. Rye had not noticed that the use of tar oil fuel had been detrimental to cylinder liners, but it had a marked effect on valves and other portions of the engine gear. He referred to the effect of granite dust in the air in the case of some engines situated near a granite quarry. The abrasive effect of the granite dust introduced into the power house when the wind was in certain quarters had caused a considerable amount of trouble in the cylinders until air-filters had been introduced.

Institute of Metals.—The annual general meeting of the Institute will be held on March 11th and 12th, at the Institution of Mechanical Engineers, when, among other papers, the following are to be read:—"Fifth Report to the Corrosion Research Committee," "The Effect of Progressive Drawing upon Some Physical Properties of Commercially Pure Copper," "The Influence of Cold Rolling on the Physical Properties of Copper," and "The Study of Thermal Electromotive Force as an Aid to the Investigation of the Constitution of Alloy Systems." The annual dinner is to be held at the Criterion Restaurant on March 12th, at 8 p.m. It is also announced that the next gathering of members will not take place on May 5th, as previously stated, but on June 10th, when a lecture on "Recent Progress in Thermo-Electricity" will be given by Prof. Carl A. F. Benedicks, Ph.D., of Stockholm.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

The salary of Mr. J. HUTCHINSON, electrical engineer to the Farnworth District Council, has been advanced by £100 per annum.

Mr. THOMAS A. EDISON celebrated his 73rd birthday on February 11th, and in connection with this event the Edison Pioneers arranged to have their annual luncheon with Mr. Edison at his laboratory, Orange, New Jersey, on that date. During the war he devoted his time to the Naval Consulting Board of the Navy Department, U.S.A., and paid the expenses of a large staff of experts. An interesting feature of the celebration is that "73" is the symbol used by telegraphers in expressing greeting.

The salary of Mr. J. DOWNIE, chief clerk of the electricity department, has been increased by the Aberdeen T.C. to £350.

Mr. H. H. PARKER is resigning his position as War Department superintendent electrical engineer, South Irish District, and is taking up the appointment of engineer and manager of the Holmfirth U.D.C. electricity undertaking, having been selected from among 127 applicants.

A correspondent is anxious to get into touch with Mr. Henry Stafford Hatfield, and would like to know his address.

Mr. W. INNES, formerly deputy electrical engineer to the Borough of Poplar, and latterly a partner in the late firm of Towler & Innes, engineers, London, has joined the board of the Westminster Engineering Co., Willesden, and has been appointed joint managing director.

At the last meeting of the Railway Telegraph and Electrical Engineers' Conference, Mr. W. WOOD, electrical engineer of the North British Railway, was elected president.

Lieutenant H. G. Ross, Devon Fortress Engineers (Electric Lights), has relinquished his commission owing to ill health contracted on active service.

Dublin Corporation Lighting Committee has elected Mr. J. FARREN, representing the Labour Party, to the chairmanship.

The *Times* announces that the First Commissioner of His Majesty's Works and Public Buildings has appointed Mr. H. BAINES, O.B.E., to be chief engineer to H.M. Office of Works, to succeed Mr. H. A. McFerran, O.B.E., who has retired.

Stoke Newington B.C. Electricity Committee has appointed Mr. E. P. LOVELL (an ex-soldier) business representative to canvass the borough for new consumers of electricity, at £4 per week, plus 10s. war bonus, and a commission of 2s. 6d. per KW. connected at his instance.

Mr. N. B. ROSHER, O.B.E., M.I.E.E., &c., has resigned his appointment with the Ministry of Munitions in order to rejoin his firm, Messrs. Moffett & Rosher, consulting and inspecting engineers, of 63, Temple Row, Birmingham.

Mr. J. S. BUCKLEY, late of the County of London Electric Supply Co., Ltd., leaves Liverpool on the s.s. *Oriana* on February 21st to take up a position with the Chilian Electric Tramway and Lighting Co., Ltd., as engineer in charge of laboratory and instrument testing.

Obituary.—MR. C. M. DORMAN.—We regret to learn that Mr. Charles Mark Dorman, managing director of Messrs. Dorman & Smith, Ltd., passed away suddenly at Llandudno on Thursday, February 12th. Mr. Dorman showed signs of illness just before Christmas, and his heart was causing anxiety to his friends. It was hoped that a few weeks' holiday at Llandudno would have been beneficial. Unfortunately his condition became very serious whilst staying at Llandudno, until he became too ill to be moved. He was a well-known pioneer of electrical work, and some of the switchgear designs originated by him in the 'eighties are still good practice at the present time. Born at Northampton in 1861, he was educated at Birkhampstead and the Yorkshire College, and afterwards served an apprenticeship in the works and drawing office of the Hunslet Engine Co., where he did much valuable work in the way of locomotive design. In the year 1881 he and Mr. R. A. Smith, who later became his partner, deserted locomotive engineering and joined the late Mr. J. S. Raworth as his assistants. Mr. Dorman carried out some of the very earliest electrical installations on board ship, and was responsible for many of the early designs of switchgear and other electrical apparatus. When Mr. Raworth left Manchester Mr. Dorman and Mr. Smith took over the small works which he had established, and have since gradually developed the important business which is now carried on as Dorman & Smith, Ltd. Mr. Dorman was of an extremely genial and hospitable disposition, and will be much missed by his many friends. His health appeared to be fairly good until a few months ago. The end came rather suddenly through heart failure. It is probable that the death of his only child, a very promising young student, who accidentally lost his life while training for military service, has been the primary cause of his comparatively early decease.

LIEUTENANT W. CHEETHAM.—Lieut. William Cheetham, of Blackpool, who recently passed away, was prior to the war employed at the Blackpool Electricity Works.

MR. G. J. T. ALDER.—The death occurred on February 9th of Mr. G. J. Thornton Alder, electrical engineer and contractor, of 53, Victoria Street, S.W. 1. Mr. G. W. Alder will continue the business.

MR. A. PRATT.—The death occurred on February 5th, after a brief illness, of Mr. Arthur Pratt, who had for 22 years carried on business as an electrical engineer at Hornsey.

NEW COMPANIES REGISTERED.

Sydney Anderson, Ltd. (163,783).—Private company. Registered February 6th. Capital, £1,000 in £1 shares. To carry on the business of electricians, motor and mechanical engineers, &c. The subscribers (each with one share) are: S. Anderson, 58a, Sydenham Road North, Croydon, engineer; P. T. Silcott, 46, Kidderminster Road, West Croydon, mechanic; W. A. S. Hellyar, 28, Park Lane, Croydon, solicitor. The first directors are not named. Registered office: Wellesley Works, Wellesley Court Road, Croydon.

Symington (Lanarkshire) Electric Supply Co., Ltd. (10,948).—Private company. Registered in Edinburgh February 5th. Capital, £2,000 in £1 shares. To carry on the business of electrical engineers, electricians, practical engineers and contractors, manufacturers of electrical apparatus, &c. The subscribers (each with one share) are: J. Cassels, Silverwells, Hamilton, solicitor; D. A. Hay, 105, St. Vincent Street, Glasgow, C.A. The first directors are: J. Cassels, D. A. Hay, T. Duncan, J. C. Jarrat, and J. W. McDonald. Qualification, 50 shares. Secretary: D. A. Hay. Registered office: 105, St. Vincent Street, Glasgow.

Hubert D. Carter (Bangor), Ltd. (163,797).—Private company. Registered February 7th. Capital, £5,000 in £1 shares (2,000 preference). To carry on the business of electrical, motor, hot water and mechanical engineers and consultants, dealers in electrical and other plant and appliances and mechanical toys, &c., as formerly carried on by H. D. Carter at Faraday House, 249, High Street, Bangor. The first directors are: H. D. Carter (governing director), Glenhurst, Colwyn Bay, electrical engineer; E. P. Carter, Glenhurst, Colwyn Bay, electrical engineer. Solicitor: A. C. F. Brookes, Public Hall, Colwyn Bay.

Telephone Installations (London), Ltd. (163,690).—Private company. Registered February 4th. Capital, £2,000 in £1 shares. To carry on the business of manufacturers and installers of private telephone systems, &c. The subscribers (each with one share) are: G. H. Hanson, 102, Gravelly Hill, Birmingham, telephone engineer; A. H. Hanson, 9, Beaufort Road, Gravelly Hill, telephone engineer. Table "A" mainly applies. Solicitors: Cochrane and Cripwell, 119, Finsbury Pavement, E.C. Registered office: 14, Snow Hill, Birmingham.

Stoneycroft Electrical Works, Ltd. (163,831).—Private company. Registered February 16th. Capital, £3,000 in £1 shares. To take over the business of a general electrical and engineering contractor carried on by F. S. Ormonde at 20, St. Anne Street, Islington, Liverpool, as the "Stoneycroft Electrical Works." The first directors are: F. S. Ormonde, 50, Inigo Road, Stoneycroft, Liverpool, electrical engineer; E. C. Day, 42, Oriel Road, Bootle, Liverpool, marine engineer; A. Huntington, 210, Edge Lane, Liverpool. Solicitors: Reynolds and Reynolds, 15, Lord Street, Liverpool.

Hackbridge Electric Construction Co., Ltd. (163,753).—Private company. Registered February 6th. Capital, £25,000 in £1 shares. To carry on the business of electrical, mechanical and general engineers, manufacturers of and dealers in transformers, radiators, dynamos, motors and all kinds of electric lighting, power and transmission plant, &c. The subscribers (each with one share) are: C. W. Bloomfield, Highlands, Foxley Lane, Purley, Surrey, engineer; R. L. Morris, 6, Eastcombe Avenue, Charlton, S.E.7, engineer. C. W. Bloomfield is permanent governing director. Solicitor: F. W. Simmonds, Broad Street House, E.C. Registered office: London Road, Hackbridge, Surrey.

Lloyd's Electro-plating Works, Ltd. (163,925).—Private company. Registered February 11th. Capital, £1,000 in £1 shares. Objects: To take over the business of electro platers, lacquerers and oxydisers of metals, &c., carried on by J. W. Lloyd, and recently by R. J. Weston (as trustee under deed of assignment) at 39, Castle Street, Derby. The first directors are: J. W. Lloyd (managing director), 39, Castle Street, Derby, electro plater; A. Green, M.P., The Knoll, Normanton, Derby; D. Sibbald, Keddleston Road, Derby, C.A. Registered office: 39, Castle Street, Derby.

Aladdin (Lancashire and Yorkshire), Ltd. (163,949).—Private company. Registered February 11th. Capital, £50,000 in £1 shares. Objects: To acquire exclusive licences for the working in the Counties of Lancashire and Yorkshire the patents belonging to the Aladdin Renew Electric Lamp Corporation, Ltd., and to enter into agreements (1) with E. J. McWilliam and (2) with J. G. McIntosh. The subscribers (each with one share) are: R. E. Ellis, 70, Madeley Road, Ealing, W.5, engineer; W. J. Underwood, 51, Creffield Road, Acton, W.3, electrical engineer. Permanent directors: E. J. McWilliam and J. C. McIntosh. Solicitor: C. B. Ellis, 70, Chancery Lane, W.C.

United Arc Welding Co., Ltd. (163,039).—Private company. Registered February 11th. Capital, £5,000 in £1 shares. To carry on business as indicated by the title. The first directors are: W. E. Groves, 76, Roman Road, South Shields, electrical engineer; H. C. Lumsden, 48, Rothwell Road, Gosforth, boiler inspector; R. Winskell, 6, Flavia Terrace, South Shields, solicitor. Secretary: C. L. Dobson. Registered office: Ferry Street, South Shields.

Mayfair Light and Power Co., Ltd. (163,836).—Private company. Registered February 9th. Capital, £1,000 in £1 shares. To carry on the business of electrical engineers and contractors, electricians, suppliers of electricity for light, heat and power, &c., and to adopt an agreement with H. Meekhonik. The first directors are: H. Meekhonik, Ambleside, Brighton Road, Purley; A. Meekhonik, 14, Pepys Road, New Cross, S.E.; H. M. Williams, Aberdeen Lodge, Powys Villas, Brighton. Solicitor: P. G. Averill, 135, Edgware Road, W. Registered office: 135, Edgware Road, W.

W. G. Perry & Co., Ltd. (163,943).—Private company. Registered February 11th. Capital, £5,000 in 4,000 ordinary shares of 6d. each and 4,000 preference shares of £1 each. To carry on the business of electrical engineers, dealers in machinery, plant and accessories, &c., and to adopt an agreement with W. G. Perry. The first directors are: W. G. Perry, 87, Birchwood Road, Wandsworth, S.W.; F. W. Cook, 155, Upper Kennington Lane, S.E.; A. Perry, 155, Upper Kennington Lane, S.E. Solicitor: J. A. Davies, Colonial House, London, Bridge. Registered office: 199, Westminster Bridge Road, S.E.

Mechanical Products, Ltd. (163,927).—Private company. Registered February 11th. Capital, £10,000 in £1 shares. To carry on the business of electrical and mechanical engineers, metal stampers, manufacturers of electrical and mechanical plant and accessories, &c. The first directors are: T. Thompson, Allbury House, Surbiton, Surrey; H. H. Oxley, Hill Top, Crowhurst, Sussex. Solicitor: H. M. Veitch, Norfolk House, Norfolk Street, Victoria Embankment, W.C. Registered office: 60-61, Blackfriars Road, S.E.1.

Stainsped, Ltd. (163,925).—Private company. Registered February 11th. Capital, £20,000 in £1 shares. To take over three contracts relating to the manufacture of and licences to work patents relating to "Pedrail" trains (1) between Pedrail Transport, Ltd., and Staines Projectile Co., Ltd.; (2) between the said Pedrail Transport, Ltd., R. H. Brackenburg, J. G. W. Lowe and Staines Projectile Co., Ltd.; and (3) contained in correspondence between the liquidator of the said Staines Projectile Co., Ltd., and Pedrail Transport, Ltd. The subscribers (each with one share) are: E. J. Almond, 119, Finsbury Pavement, E.C., secretary; R. J. Rawlinson, 184, Windsor Road, Ilford, Essex, clerk. The subscribers are to appoint the first directors. Solicitor: R. H. Parratt, 18 and 19, Pall Mall, S.W.

H. T. Baker & Co., Ltd. (163,967).—Private company. Registered February 11th. Capital, £2,000 in £1 shares. To take over the business carried on by H. T. Baker at 117, Albert Road, Stechford, as "H. T. Baker & Co.," and to carry on the business of electrical, mechanical, cycle, motor, sanitary, civil and general engineers, &c. The permanent directors are: H. T. Baker, 117, Albert Road, Stechford; H. E. Thomas, Services Club, Stratford Place, W. Qualification, £50. Secretary, W. T. Hurtt. Registered office: 125, Edmund Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Aluminium Corporation, Ltd.—Mortgage on premises and cottage, &c., at Mienan, Carnarvon, registered January 19th, 1920, to secure £1,800. Holder: Sir A. H. Walker, Kt., 2, Maresfield Gardens, Hampstead.

Electro-Medical Treatment, Ltd.—Particulars filed January 21st, 1920, of £2,000 debentures, charged on the company's undertaking and property, present and future, including uncalled capital, amount for present issue being £1,250.

Siemens Brothers & Co., Ltd.—Satisfaction registered January 14th, 1920, to the extent of £22,400, of charge for £1,330,000, registered January 21st, 1918.

Vickers, Ltd.—Satisfaction registered January 17th, 1920, of charge for £1,000,000, registered February 20th, 1903.

Taranto Tramways & Electric Supply Co., Ltd.—Mortgage on certain concessions, &c., and the company's undertaking and property, present and future, including uncalled capital, registered January 14th, 1920, to secure £72,000. Holders: Commercial Bank of Scotland, Ltd.

CITY NOTES.

Westminster Electric Supply Corporation, Ltd.

During the year 1919 the total lamps, motors, &c., connected increased from 50,166 KW. to 52,457 KW. After allowing for depreciation, sinking fund, and other charges, and paying the dividend on the 4½ per cent. preference shares, a final dividend at the rate of 13 per cent., less income tax, is to be paid on the ordinary shares, making 10 per cent. for the year, and £15,473 is to be carried forward. The directors make the following reference to the Electricity Supply Bill:—

> The Electricity (Supply) Bill introduced by the Government last year has now become law. This Bill, owing to the strong opposition in the House of Lords, directed specially against its financial proposals was considerably modified in both Houses of Parliament. Eventually all its compulsory provisions were withdrawn, and the valuable proposals, relating to the appointment of Commissioners and the control and advice which they are enabled by the Act to give in connection with the development of electricity in the country, were retained.
>
> The Act now enables the different companies and authorities and others in a district to combine to form a joint electricity authority for the district, and the leading London companies have already associated themselves for this purpose. It is hoped that by the formation of such an authority arrangements may be put in force whereby the best and most efficient use will be made of the resources and experience of the different undertakers which will result in electricity being produced and sold at the cheapest possible rate, while at the same time the rights and interests of the shareholders will be duly safeguarded.

Units generated, 27,867,237; total utilised, 25,543,795; expended in distribution, 1,651,081.

Melbourne Electric Supply Co., Ltd.

At the annual meeting on Monday, Mr. J. B. Braithwaite said that including the sums now being issued they would have increased the capital by £300,000 since that time last year, and as the ordinary shares were being issued at a premium of 25 per cent., they would really get £325,000 additional capital. Some might think they were issuing capital too fast, but they were only raising money when they could see an immediate profitable return on it. They had transferred £20,501 from profit and loss and £4,999 from premium account to the general reserve, raising that fund to £140,000. For technical reasons the auditors stated in their report that "no specific reserve has been made against depreciation." When a company was liable to be bought up at a certain time, it was very unwise to admit in their balance sheet that they required to make a provision which in their case amounted to £140,000, for depreciation. They did not require it, and therefore they had carefully avoided putting the sum to depreciation reserve, but he could assure them they were making ample reserves in that direction. In spite of drawbacks they had had to contend with, they were nearly £20,000 to the good on their net earnings. The improvement was shown all round. Private supply yielded £165,688, as against £144,218, an improvement of £21,000; power, heating, &c., yielded £83,476, against £79,878; public supply showed a slight increase, being £12,408, as against £11,746, and the supply to the tramways had yielded £50,970, as compared with £48,940. Bulk supply showed the most satisfactory percentage of increase—the receipts having increased from £8,160 to £9,848. The meter rents yielded £15,094, a small increase. As to Geelong, there again they could not boast of any large increase, but the balance carried to profit and loss was £13,087, as against £12,988, so that the actual results there were not unsatisfactory when they remembered that they had had to contend against three rather serious strikes during the year. The seamen's strike had the effect of putting them in considerable difficulty in regard to their coal supply, and it was only due to the foresight and energy of their staff in Melbourne that they did not have some serious interruptions in their supply. As it was they managed to pull through fairly well on the whole. Had it not been for those strikes their increased profit of £20,000 would have been materially larger. He could only hope that the country would be free from such visitations this year. They had had rather an important increase in their area during the year—22 per cent., with an increase in population of about 11 per cent. They were now serving a district which had a population of 407,000, and they had increased the street mileage during the year by 36, bringing up their total to 660 miles of streets in which they were now giving a supply. That accounted for some of the large capital expenditure they had had to incur. They were also engaged in somewhat extensive capital expenditure at Geelong, which they hoped would prove profitable in future years; at one time they thought Geelong would be quite a small station. Last year at Melbourne they had added 5,560 consumers, which was a record for the whole period of their existence, and 18 per cent. better than the previous 12 months. If they reckoned their consumers in districts where they were giving a bulk supply, it would be seen that they were supplying about 51,000 consumers. Taking the population into account, those figures were in excess of anything that had been achieved by any English company. The outlook for the current year was extremely satisfactory. Up to date they were considerably better off in net profits than they were for the same period a year ago, and that their consumers seemed to be multiplying if anything at an accelerated rate. The number connected during the last month of which they had the record was between 800 and 900. If the increase should be maintained in anything like the same ratio it would show an extremely good result for the year, as last year the increase was at the rate of about 500 per month. They had started the year under good auspices, and if they were spared a recurrence of strikes and other labour troubles, he thought they had every reason to anticipate a successful year. The people who really earned their money for them lived 12,000 miles away, and they owed a great deal of the prosperity and success of the company to Mr. Clements, the managing director, and the local board in Melbourne.

In reply to a shareholder, the chairman said that most of the company's concessions expired in 1925, but he doubted very much whether anybody in Australia had got the money to buy them out, even if they wished to. They must bear

in mind that in recent years particularly they had been giving a bulk supply to an increasing number of municipalities, and he did not think they would find any advantage in purchasing them, even if they had the money. The terms of purchase were more satisfactory than they were under the English Electric Lighting Acts.

A vote of thanks was passed to the local board in Australia and the staff.

Yorkshire Electric Power Co.

At the annual meeting, on the 17th inst., Mr. A. G. Lupton, who presided, said that an increase of revenue of over 30 per cent. was satisfactory, especially for a year of reconstruction. The general adoption of a shorter working week in the early part of the year, and the various labour disputes including the Yorkshire miners' strike, the railway strike, and the moulders' strike, all had their effect in retarding development. Working costs had been heavy owing to the price of coal, stores, and wages. The reduction of working hours had necessitated an increase in the number of the company's employés, and in addition the rates of wages paid had been increased. The salaries and wages paid by the company in 1913 were 27 per cent. of the total expenditure. In 1919 this had increased to 40 per cent. The extra costs had been met by the increase of revenue. The capital account showed the assets of the company standing at over one million pounds. Due to the large increase in the cost of machinery and mains which had taken place as a result of the war, a valuation of the plant would show the present value to be largely in excess of the book figures. It was satisfactory that all classes of power users were realising the advantages of co-operating through the agency of the company, and are not only using its supply but were subscribing a proportion of the capital. The Electricity Supply Act recognised and endorsed the principles by which this company had always stood—that of generation in large central stations and distribution throughout large areas, and it was now the duty of this company to respond to the call made upon it, and take its full share in developing the area committed to it. The value of economies in the use of coal and capital on which the company's business depended had been largely increased by the higher cost of coal and machinery, and the advantages to the user were therefore proportionately greater. These high costs, and the scarcity of labour, were rendering manufacturers daily more disposed to devote themselves to their own proper business, and to look to this company to provide their motive power as and when they required it. As a consequence, demands for current were pressing from every side, and fully justified the large extensions for which they were now asking them to provide the capital. A company with an area such as theirs could not stand still; it was like a river which gathered volume as it flowed. Not only was the demand for power increasing more rapidly, but the smaller electricity supply undertakings were deciding to purchase in bulk from the company rather than to continue to generate electricity in small and relatively inefficient stations. Out of the 55 electricity supply undertakings in the company's area arrangements had been made in 41 cases for bulk supply or joint working, so that the unification of supply over the whole of the company's area was within measurable distance of completion. Agreements had been made with some of the larger municipalities for interchange of supply in the spirit of the Coal Conservation Report, which had already been mutually advantageous. They hoped to carry these a good deal further. They had now nearly 400 miles of mains bringing in good revenue, and the time had come when the company must take another great step forward. They therefore asked the meeting in the first place to consolidate the company's finance by authorising an issue of debentures to repay loans from the bankers and the Government, which had been spent on plant and mains already earning good revenue for the company, and secondly, to take part in the issue of further ordinary shares. They would offer the debentures, a 5½ per cent. security, at a price which would bring a return to investors of 6½ per cent. The development of the new station at Ferrybridge had been held up. The station was urgently required, and it was grievous that so much delay had been forced upon them by legislative uncertainties, and that it was only now possible to go forward with the preparation of plans for what was so urgently required. These plans would take time to prepare, and when complete would require considerable additions of capital, but the funds now asked for would enable extensions to be made, and would widen the basis of the company, and enable it to carry on and to earn revenue which would justify the further advances as they became necessary. The chairman alluded to the energy and devotion of the engineer and manager, Mr. Woodhouse, and his competent staff.

London Underground Electric Railway Companies.

Central London Railway Co.—Report for 1919. Total net income £186,917, a decrease of £40,656. Brought forward, £17,484. Interest, rentals, &c., absorb £46,089: to reserve, £20,000; preference dividend, £21,600. Available balance £116,762, a decrease of £20,723. After paying the dividends mentioned in our last issue, £11,762 is to be carried forward. Capital expended during 1919, £7,409. The gross revenue of the five companies contributing to the common fund was increased by £2,497,018, or 32 per cent. during the year; operating expenses and interest and reserves by £2,632,321, or 37 per cent. The amount available for dividends and further reserves decreased £135,303 or 21 per cent. The full effect of the increased cost of wages, fuel, and other supplies was not felt in 1919. The working costs are to-day at an even higher ratio to earnings than during 1919. If sufficient revenue is to be obtained to meet the working expenses to provide for adequate depreciation and renewals, and to obtain a reasonable return on capital, fares must be increased, and a Bill has been introduced seeking authority. Works in connection with the electrification of the Ealing and Shepherd's Bush railway of the G.W.R. are rapidly approaching completion, and it is hoped that Central London trains will be running at an early date between the city and Ealing Broadway station. Baron Ashfield, of Southwell, having resigned from the presidency of the Board of Trade, has been elected chairman and managing director.

London Electric Railway Co.—Report for 1919. Total net income £611,601, a decrease of £39,003. Brought forward, £23,605. Interest, rentals, &c., absorb £290,738; to reserve, £45,000; preference dividend £126,947. Available balance, £172,521, a decrease of £47,643. After paying the dividends mentioned last week, £30,942 is to be carried forward. Capital expended during the year, £6,898. The report contains observations similar to those quoted above in the Central London reference, respecting the revenue, &c., of the five companies, and action respecting future fares.

Metropolitan District Railway Co.—Report for 1919. Total net income, £565,611, a decrease of £18,091. Brought forward, £21,332. Interest, rentals, &c., £336,115; to reserve, £45,000; dividends on guaranteed and first preference stocks, £124,930. Available balance, £80,898, a decrease of £23,933. After paying dividends mentioned here last week, £22,098 is to be carried forward. Capital expenditure of the year £1,499. Orders have been placed for a large number of additional carriages of an improved type. The above remarks regarding revenue, expenses, fares, &c., also apply in this case.

City and South London Railway Co.—Report for 1919. Total net income £144,486, a decrease of £7,918. Balance brought forward £24,567. Interest, rentals, &c., £47,203; to reserve £25,000; preference dividend, £42,500. Available balance, £54,350, a decrease of £4,817. After paying dividends already announced a further £5,000 is put to reserve, and £19,750 is to be carried forward. Capital expended during the year, £10,800. Experimental work in connection with the enlargement of the tunnels is being carried out with the object of determining the most efficient method of reconstructing the railway. The above remarks regarding revenue, expenses, fares, &c., apply in this case also.

The following table shows the operating expenses of the above four companies and the L.G.O. Co., comparing 1919 with 1918 :—

	1919. £	Inc. or dec. £
Traffic receipts	9,110,469	+2,156,078
Government compensation (after providing for adjustments)	566,370	+ 263,751
Total	9,676,839	+2,419,829
Operating expenses	8,179,598	+2,645,983
Net receipts	1,497,241	— 226,154
Miscellaneous receipts (net)	563,630	+ 77,189
Net income...	2,060,871	— 148,965
Interest, rentals and other fixed charges	828,507	— 33,662
Balance	1,232,364	— 115,303
Reserve for contingencies and renewals.	420,000	+ 20,000
Balance	812,364	— 135,303
Dividends on guaranteed and preference stocks, excluding M.D.R. second preference stock	315,977	—
Surplus paid into or deficit met out of common fund	496,387	— 135,303
Amount received from common fund ...	496,387	— 135,303
Per cent.	100%	—
Add balances from last year's accounts...	147,918	+ 17,273
Total amount available for dividends and further reserves	644,305	— 118,030

The following table shows the passengers carried, average fare per passenger, and the number of car miles run in 1919 compared with 1918 and 1913 : :—

	1919.	1918. Inc. or dec.	1913. Inc. or dec.
Passengers carried :			
Ordinary	956,696,890	+163,207,971	+197,532,168
Workmen	68,503,288	+ 6,066,590	+ 21,472,001
Season	48,192,370	+ 1,235,571	+ 24,254,169
Total... ...	1,073,392,548	+170,510,132	+243,258,338
Average fare per passenger	d. 1·99	d. +·19	d. +·54
Car miles run ...	130,977,237	+ 18,790,138	— 7,201,770

Metropolitan Railway Co.—Speaking at the annual meeting, Lord Aberconway, P.C., said that so long as the control continued the position would necessarily remain as it was, and very little, if any, variation in dividend could be looked for. They had an excellent property, with an increasing earning capacity, but the heavy increase in the cost of working, brought about mainly by the concessions made to the staff by the Government, had for the time being turned their profit into a loss, in spite of the largely increased turnover of business. The position must be adjusted in the same way as was being done in every other business concern, namely, by raising the price of the commodity they had to sell. The whole matter was before the Ministry of Transport at the present time, and very soon something would be done. They would not reap any immediate benefit from such increased fares, as the extra revenue would only go to reduce the amount payable to them by the Government under their guarantee, but it was necessary that the fares should be put upon a satisfactory basis in view of the time when the subsidy from the Government would cease. The traffic not only on their line but on the other London lines had already outgrown the facilities, and the expenditure of large amounts of capital was necessary if the transport accommodation was to keep up with the growth of the population. The housing question and the necessity for improving the conditions of life of the people employed in their big centres were totally bound up with the question of transport, and if the capital required for the necessary extension was to be forthcoming the companies would have to be in a much sounder commercial position.

Llandudno & Colwyn Bay Electric Railway, Ltd.—The annual meeting was held on February 11th. The chairman said that the financial result was disappointing when taken in conjunction with the increase in traffic receipts. It was due to increased operating expenses, repairs, and maintenance. The work of overhauling the rolling stock was greater than was anticipated, and repairs and maintenance charges—permanent way and overhead lines—would be heavy for some little time. Power expenses were heavier, due to the increased charge, and there could be little relief on this item during the current year. The Old Colwyn extension still proved a valuable addition to the line; if this had not been built they would have been incurring a heavy loss in operating the tramways outside of the holiday season. They honed shortly to place an order for additional cars, but their ability in this connection was limited by their financial resources and the increased cost of cars. Traffics were showing a slight increase as compared to a year ago, but the costs continued to increase, and further demands from labour might have to be met to some extent. They honed, however, that the increase in traffic receipts would suffice to overcome the increase in operating expenses.

General Electric Co., Ltd.—At meetings of the company's shareholders held last Saturday, approval was given to a proposal to issue new capital in the form of 7½ per cent B cumulative preference shares and partly in the form of ordinary shares. Mr. Hirst said that considerable progress had been made with the programme to which he referred at the annual meeting for proceeding with developments and increasing the capital to £6,000,000. Those developments had been proceeding with the assistance of the bankers, but the issue of further capital was now necessary, though it could not be done on the same conditions as the last increase. Resolutions were passed under which the 1,655,790 issued preference shares and 144,210 of the unissued preference shares will be called "A" preference shares; the 1,800,000 unissued preference shares will be converted into 7½ per cent. "B" cumulative preference shares.

Prospectus.—The Still Engine Co., Ltd.—This company, which was formed last year to acquire from the Engine Development Co., Ltd., and other vendors, the patents for the Still engine (with the exception of the Japanese patents which had been disposed of), has been offering 75,000 shares of £1 each for subscription at par. The list was to close on Wednesday. The nominal capital is £300,000, 145,000 shares are being issued as fully paid, and £10,000 cash consideration is also to be paid out of the proceeds of the present public issue, the balance being for working capital. A number of agreements for licences have been entered into with well-known firms in this country and in France, and other negotiations are in progress. The objects of the company are to sell further licences, to continue research work on the Still engine for the benefit of its licensees, and to deal with the foreign patents.

Electrical Distribution of Yorkshire, Ltd.—In their report for 1919 the directors state that the net profit was £4,354, against £3,168 for 1918, and £3,693 for 1917. £886 was brought forward. After paying 6 per cent., free of tax, on the ordinary shares, £1,000 is added to reserve, and £1,279 is to be carried forward. The manner in which the company has passed through the war period has demonstrated the soundness and stability of the business.

Restrictions on the use of electricity were not completely withdrawn until the latter part of the year and, due to industrial disturbances throughout the country, the delivery of material was greatly delayed so that the growth of the company's business has been retarded. Applications for the company's supply have been received in large numbers and with the restoration of normal industrial conditions a rapid expansion of the company"s business is assured. This will require the issue of further capital, and shareholders are recommended to apply for further shares.

Tyneside Tramways & Tramroads Co.—At the meeting held in Newcastle on 10th inst, Dr. J. T. Merz said that the revenue for the year had increased by more than £7,000, but so far from increasing their earnings, they were lower, for the increased costs had been more than double the increase of the revenue. As a consequence, they had some £7,200 less to deal with. The outlay upon repairs, materials, and wages was much greater than it had been. They had to deal with £11,120, to which they had added £3,000 out of the special reserve which was put aside to meet repairs which should have been carried out in former years. They proposed to pay the same dividend as in the previous year. As to prospects, the traffic return showed some increase, but that should not mislead them, as it was probable that the costs would increase at a greater rate than did the revenue. They hoped that their income would be improved by the acquisition of three new cars which they had ordered. The trade in the district had been very much interfered with, especially by the moulders' strike, which threw many men idle and affected the traffic.

Dublin United (Electric) Tramways Co., Ltd.—The Right Hon. L. A. Waldron, P.C., who presided at the recent meeting, said that on the whole they had had a prosperous year. The services were now nearly normal again, coal shortage and other difficulties that arose in wartime being less acute, though the coal supply was again causing considerable anxiety. The introduction of an 8-hour day for their men had entailed the employment of an extra 200 in the traffic department. The advance in wages over pre-war rates now stood at 28s., and a further demand was being made. They had heavy track renewals before them. The running of the power station had been very satisfactory, and the cost of generating the unit came to .979d. A new sub-station now in operation at College Street would help towards economy and add to the efficiency of distribution. They proposed to build covers on the upper decks for all cars except those which had to pass under railway bridges.

Paisley District Tramways Co.—Revenue during 1919, £126,530; expenses, £100,238. General interest requires £130, income tax £5,766, debenture interest £3,200, debenture sinking fund £1,500. Including £6,072 brought forward the balance is £21,767. £6,000 has been put to reserve, 5 per cent. has been paid on the preference shares, and £2,000 put to preference share sinking fund; £6,267 is to be carried forward. Traffic receipts increased by £5,454, but expenditure increased by £20,418, due to rises in wages, shorter hours, and a further great rise in the cost of materials. The full effect of these increased charges on a complete year's working has still to be borne. Increases in fares were sanctioned, and came into force in November, but it is not anticipated that in the current year the relief obtained by these altered fares will cover the increased costs, and it may be necessary to make application for further modifications.

Chloride Electrical Storage Co., Ltd.—The directors have put forward a proposal for the capitalisation of £73,250 out of the reserves and undivided profits, and the distribution of this sum in the form of bonus shares to ordinary shareholders in the proportion of one new £1 share to every two shares now held. It was only three years ago—in March, 1917—that the then ordinary share capital of £73,250 was doubled by the distribution of bonus shares of £1 each on a share per share basis. The present proposal would increase the ordinary share capital to £219,750, of which £146,500 would have been provided by the payment of bonus shares. In 1912-13 there was also a bonus of 7s. 6d. per share, which was met by an allotment of fully-paid ordinary shares.—*Daily Dispatch*.

Lanarkshire Tramways Co.—Revenue for 1919 £199,868, expenses £148,060, leaving £51,808. Contributions to local authorities, £4,001; debenture interest, £650; interest accounts, £4,182; depreciation reserve, £12,000; maintenance reserve, £5,000. Adding £5,912 brought forward, the balance is £31,888. After paying 7½ per cent. for the year on the shares, and £883 to directors, £5,280 is carried forward. Revenue increase, £7,338; expenses increase £22,010. Expenditure of £7,816 on deferred repairs has been charged against maintenance reserve account. The deferred repair work was not completed at December 31st. The strike of traffic employés in April and May caused a loss of £10,000 in traffic revenue. Passengers carried, 1918, 31,695,400; 1919, 31,521,049.

South Metropolitan Electric Light & Power Co., Ltd.—Credit balance for 1919 £70,109, plus £12,857 brought forward, also 10 per cent. dividend on holding in West Kent Electric Co., Ltd., £1,002; total £83,968. Debenture and other interest £15,355; 7 per cent. dividend on cumulative first preference shares and 6 per cent. on the second; £21,500 to depreciation; £10,000 to reserve; 6 per cent. dividend on the ordinary shares, less income tax, £9,000; to be carried forward £12,323. The general business has been well maintained, notwithstanding a large, but it is hoped temporary, reduction in bulk supply demand. Mr. H. W. Bowden has resigned as a director and engineer-in-chief, but he will act as the consulting engineer.

Oxford Electric Co., Ltd.—Dividend 5 per cent. on ordinary shares.

Stock Exchange Notice.—The Committee has specially allowed dealings in the following under temporary regulation 4 (3):—

English Electric Co., Ltd.—148,004 preference shares of £1 each, fully paid, Nos. 404,525 to 552,528; 33,973 ordinary shares of £1 each, fully paid, Nos. 1,397,537 to 1,431,509.

National Electric Supply Co., Ltd.—The directors report that the extensions to the generating plant could not be completed for this winter's load owing to strikes, &c. There is put to depreciation £5,000, to reserve £3,000, dividend 5s. per ordinary share, making 7s. 6d. for the year, dividend 27s. 2d. per founders' share, carried forward £1,036.

Central Electric Supply Co., Ltd.—The report states that energy has been supplied to the Westminster Electric Supply Corporation, the St. James' and Pall Mall Co., and the Chelsea Electricity Supply Co. to an amount of 36,096,110 units.

National Boiler & General Insurance Co., Ltd.—Final dividend of 18s. per share, less tax, in addition to 12s. interim dividend. To investment reserve £6,410. Carried forward £4,347.

Bournemouth & Poole Electricity Supply Co., Ltd.—Final dividend on the ordinary shares at the rate of 7 per cent. per annum, less tax, making 6 per cent. for the year.

London Electric Supply Corporation, Ltd.—Dividend 2½ per cent. for 1919; £12,500 to reserve; £5,000 to contingencies; £11,500 carried forward.

Crossley Bros., Ltd.—Dividend at the rate of 10 per cent. per annum on the ordinary shares for the half-year, making 8 per cent. for the year.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange acknowledges a distinct tendency on the part of its market to lapse into quietude. This spells lower prices, as a matter of course. Business is the reverse from exciting. Buoyancy and bullish enthusiasm are superseded by a critical attitude in the investor and the speculator. New issues are lavishly offered, and divert attention from the existing securities with which they come into competition. The Stock Exchange enters upon the Lenten season with a befitting decorum.

General Electrics stand out with noticeable strength. Details of the new issue of ordinary shares began to leak out generally a few days back. They were stated here a fortnight ago. One new ordinary share at 27s. 6d. for every three shares at present held was the forecast here, and although no official confirmation is forthcoming up to this evening, the matter will doubtless be made public very soon. An issue of 7 per cent. "B" preference may be expected, with the present 6½ per cents. turned into "A" shares. A comprehensive scheme, and one that is likely to arouse public interest. Other shares in the manufacturing group are somewhat featureless. British Aluminium are 1-32 higher and Siemens a florin up. Automatic Telephones dropped to 17s. 6d., rallied to 23s. 6d., and, at the moment, are easier again at 22s. 6d. Indignation is expressed at the directors' proposals, but unless a leader steps forward to focus the opposition, it may be that the scheme will be passed. One of the extraordinary points about the business is the fact that the scheme requires for its operation the assent of only 51 per cent. of the shares. The board could hardly have asked for a more slender majority than this. Without further opportunity of voicing their dissatisfaction, some of the shareholders declare that they will not send in their acquiescence.

The Home Railway market is better in places, and, though Districts have fallen to 19 and Central London ordinary to 55½, Underground Electric "A" shares are better at 7s., and the £10 shares at 2¼. There has been a slight spring during the last day or two in the heavier railway stocks, and this has encouraged the improvement in the issues of the Underground Electric Co. The attention of the speculative investor might be usefully turned to the prospects of East London 4 per cent. "B" debenture stock.

Electricity supply shares are quiet. Metropolitans rose ½ to 3¼, and Charing Cross preference recovered the dividend of 2s. 3d. There is not much business doing, but inquiries for shares find little floating supply with which to satisfy their demands. In the foreign list, Madras Electric are better at 18s. 6d. Canadian General Common have risen to 128½, and most of the dollar securities show adavnces, in consequence of the movements in the American rate of exchange. Rises and falls are out of all proportion to the amount of trade transacted, and, as a rule, the alterations are made simply in order to bring London quotations into line with those current in New York and Montreal.

Brazilian Tractions have again given way this time to 54. The Mexican group is heavy. Mexico Trams 5 per cent. bonds at 42½ are 3½ points down, and the 6 per cent. bonds at 32½ show a drop of 2. Meanwhile, it is said that the Commission which came to London to see what could be done in order to improve matters in connection with Mexican finance, is still working with a view to straightening out the chaotic condition of Mexican matters. But apparently no particular progress has been made in this direction, and the boomlet which took place in all Mexican securities some four or five weeks ago has proved to be premature. At the same time, it would appear to be indiscreet to sell Mexicans at the present time, when any day might bring a revulsion of feeling in favour of the stocks. Bombay Electric preference at 17 are another 30s. higher. Anglo-Argentine second preference at 3½ are 10s. down, which is natural enough, in view of the fact that last week these shares were quoted higher than the first preference. Potteries Electric Tractions have gone back to 13s. British Electric Traction 5 per cent. debenture stock is lower at 82.

Marconis hold their firmness at 4 3-16. Great Northern Telegraphs are down £3 in consequence of the exchange rate.

Eastern Extensions have recovered to 20, but there is no particular change otherwise in the Eastern group. Chile Telephones are a sixteenth up at 6 7-16. Our attention has been courteously called to the fact that this company paid a dividend last year of 6 per cent., and, although for 1917 and 1918, as stated in our lists, the dividend was 8 per cent., the yield should be worked out on the basis of 6 per cent., which was paid free of tax. Oriental Telephones are 1-16 up. West India and Panama shares are equally higher at 1¼. Automatic Telephones have settled down to the neighbourhood of 22s. 6d., as already mentioned. The rubber market is quiet, owing to the price of the raw material remaining at a shade under 2s. 9d. per lb., but the shares of the leading companies are in demand, on expectations, some of them already fulfilled, of reorganisation of capitals. Business amongst base metal shares is meagre, and in the iron and steel group the investor holds his hand, pending the next developments in connection with nationalisation.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Feb. 17, 1920.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	8	6½	—	£6 7 0
Charing Cross Ordinary	4	4	3⅞	—	5 6 8
do. do. do 4½ Pref.	4½	4½	2½xd	+ ⅜	8 8 8
Chelsea	5	3	3½	—	4 12 4
City of London	8	8	13⅜	—	5 16 4
do. do. 6 per cent. Pref.	6	6	9⅜	—	6 4 8
County of London	7	7	9⅜	—	7 3 7
do do. 6 per cent. Pref.	6	6	9	—	6 13 4
Kensington Ordinary	7	6	5½	—	5 14 3
London Electric	Nil	Nil	1⅜	—	—
do. do. 6 per cent. Pref.	6	6	9½	—	8 11 6
Metropolitan	4	5	8⅝	+ ⅛	6 9 6
do. 4½ per cent. Pref.	4½	4½	2⅝	—	7 16 6
St. James' and Pall Mall	9	10	6¼	—	7 13 10
South London	5	5	3⅝	—	7 12 8
South Metropolitan Pref.	7	7	1	—	7 0 0
Westminster Ordinary	9	8	6	—	7 10 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	92½	+1	6 9 9
do. Def.	14	8⅜	21	— ½	7 1 2
Chile Telephone	8	8	6 7/16	+ 1/16	1 13 2
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	20	+ ⅛	*5 0 0
Eastern Tel. Ord.	8	8	195	—	*5 2 7
Globe Tel. and T. Ord.	7	8	20	—	*4 18 6
do. do. Pref.	6	6	9⅜	+ ⅛	6 4 8
Great Northern Tel.	22	22	22½	—3	8 17 6
Indo-European	13	13	48½	—	6 18 4
Marconi	20	25	4 3/16	—	6 0 0
Oriental Telephone Ord.	15	10	2 1/16	—	4 16 0
United R. Plate Tel.	8	8	8⅛	+ 1/16	*4 19 3
West India and Panama	1/3	1/3	1¼	+ 1/16	5 11 1
Western Telegraph	8	8	20½	—	*4 17 7
Home Rails.					
Central London Ord. Assented	4	4	56½	—3	7 9 7
Metropolitan	1	1½	22	—	5 8 8
do. District	Nil	Nil	19	— 1	Nil
Underground Electric Ordinary	Nil	Nil	9⅜	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/-	+1/-	Nil
do. do. Income	4	5	7⅝	—	—
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	87	—	7 14 10
Anglo-Arg. Trams. First Pref.	5½	Nil	9⅝	—	—
do. do. 2nd Pref.	—	—	3⅜	— ⅛	—
do. do. 5 Deb.	5	5	63½	—1	7 15 0
Brazil Tractions	—	—	54	—1	—
Bombay Electric Pref.	6	6	17	+1½	3 10 7
British Columbia Elec. Rly. Pfce.	5	5	64	—	7 15 0
do. do. Preferrred	Nil	2½	56xd	—	8 18 6
do. do. Deferred	Nil	Nil	48xd	—	6 10 5
do. do. Deb.	4½	4½	64	—	6 15
Mexico Trams 5 per cent. Bonds	Nil	Nil	42½	— ½	Nil
do. 6 per cent. Bonds	Nil	Nil	32½	—2	Nil
Mexican Light Common	Nil	Nil	2¾	—	Nil
do. Pref.	Nil	Nil	3⅝	—	Nil
do. 1st Bonds	Nil	Nil	53½	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅜	—	*4 2 9
British Aluminium Ord.	10	10	1⅞	+ 1/32	5 14 3
British Insulated Ord.	25	12½	2⅛	—	5 14 2
Callenders	25	25	3⅜	—	6 9 10
" 6½ Pref.	5	6½	4⅛	+ ⅛	6 16 10
Castner Kellner	25	20	4	—	—
Crompton Ord.	7	10	22/6	—	8 17 10
Edison-Swan, "A"	—	10	1½	—	8 0 0
do. do. 5 per cent. Deb.	4	5	7⅜	—	6 5 2
Electric Construction	10	10	1½	—	8 0 0
Gen. Elec. Pref.	6	6½	10/6	—	6 13 4
do. Ord.	10	10	2½	+1/-	*4 9 6
Henley	25	25	2	—	5 14 3
do. 4½ Pref.	4½	4½	3½	—	6 4 3
India-Rubber	10	10	15½	—	*6 9 0
Met.-Vickers Pref.	—	—	3⅞	—	5 0 4
Siemens Ord.	—	10	30	+2/-	*6 13 4
Telegraph Con.	20	20	29½	+1	*4 1 4

* Dividends paid free of Income Tax.

THE PROTECTION OF A.C. SYSTEMS WITHOUT THE USE OF SPECIAL CONDUCTORS.

By Major KENELM EDGCUMBE, R.E.(T.), M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

Under present conditions, almost every network consists of a collection of cables laid at various dates, so that no system of protection which involves duplicate cores, pilot leads, conducting sheaths, or the like, can be regarded as a general solution of the problem. The methods adopted must be such as can readily be applied to the various sections of an existing system as well as to any future extensions. The author believes the four cardinal points of a protective system to be: (1) The maintenance of continuity of supply. (2) Simplicity of the apparatus involved. (3) Adaptability to existing gear with minimum alterations, and flexibility as regards future extensions. (4) Economy in its true sense, having regard to the capital sunk in cables, &c. The present paper is an attempt to show how these ideals can be obtained by simple means and with well-tried apparatus, without recourse to special conductors which, however desirable in themselves, are, more often than not, quite out of the question.

Whatever advantages may, at one time, have been claimed for the insulated neutral, it is now fully recognised that the advantages are all in favour of earthing, and the protection against over-pressures (whether due to atmospheric effects or to intermittent earths), which is afforded by the damping effect of a resistance in the earth circuit, is seen to be so important that both American and Continental practice are fast following the lead given by this country. In the present paper, earthed systems alone are dealt with since, in the author's opinion, the first step towards the attainment of satisfactory protection is to earth the system through a resistance. At the same time, many of the arrangements recommended are also applicable to insulated systems.

Apart altogether from the value of earthing through a resistance as a protection against over-pressures, it affords a means whereby the majority of faults can be cleared in their initial stages as single-phase leakages to earth, instead of being left on the system until they have developed into short-circuits between phases.

Fig. 1 illustrates the application of the leakage protection principle to a circuit breaker. The three-phase generator G, with earthed neutral, is connected to a feeder, the three cores of which are surrounded by the iron circuit of a current transformer C T having a single secondary winding, connected to a relay R. Under normal conditions, no matter how much the load may be out of balance, the sum of the three currents is zero, and the resultant flux in the transformer core will be negligibly small. An earth fault on any phase, however, will upset the balance in the three lines and induce a current in the secondary of the transformer, causing the relay to operate and the breaker to open the circuit. Fig. 2 shows a similar arrangement, but in this case three separate current transformers are connected in star and the leakage relay L R is included in the common return. An objection to leakage protection when used by itself is that, should the fault either start as, or immediately develop into, a short-circuit between phases, there will be no out-of-balance current and, consequently, the leakage relay will not act. To obviate this, overload relays O R, and O R, can be included in two of the branches, as shown in fig. 2, and under these circumstances one at least of the relays will act under all possible fault conditions. One of the principal advantages of such an arrangement lies in the smaller current with which the circuit breakers are called upon to deal; the earth current can best be limited by an earthing resistance connected between the generator neutral and "earth" (E R in fig. 2). Discriminating action can be obtained by giving the various relays different time-lags. The time interval between the operation of successive relays in series must not be less than that required for the opening of the breaker after the closing of the relay contacts, or the second breaker may commence to act before the first has isolated the fault. Modern switchgear may be relied upon to open the circuit within about one-fifth of a second or even less, but older gear will probably take considerably longer. To this time must be added that required for the relay to operate, as well as a margin for contingencies. It may be assumed in general that intervals of ½ second should be sufficient for quick-acting gear or ¾ second with less efficient patterns.

Such graded time-lags, when applied to overload relays, have a further very important advantage which does not seem to have received the attention it deserves. Although the short-circuit current of a modern alternator is comparatively small, probably not more than twice to three times its full-load current, yet the momentary current flowing into a short-circuit may be ten times as great as the steady value. This is due to the fact that, whilst the steady short-circuit current is limited by a weakening of the field owing to armature reaction, this field necessarily dies away but slowly, and during the interval the current is limited by resistance and inductance alone. Fig. 3 is a typical curve indicating the way in which the current rises to a maximum and then gradually falls to its steady value. Now in the case of a dead short-circuit occurring close to the generating station, if the breaker were to open instantly it would have to break a current nearly seven times as heavy as if it opened after 1¼ seconds, as would be the case with the settings proposed. The further from the generating station a fault occurs the more the short-circuit current will be reduced by the impedance of the intervening feeders, so that shorter time-lags can safely be given to the relays.

More interruptions of supply are caused by opening circuits prematurely than by leaving a fault on the system for too long a time. An interval of two seconds should probably be regarded, however, as the upper limit, and for sub-stations containing synchronous machinery this figure must be considerably reduced. If fixed time-lags are employed they must be made sufficiently short to deal adequately with short-circuits; and, as a result, cables may be disconnected unnecessarily on the occurrence of small momentary overloads. For these reasons inverse time-lags are in every way to be preferred.

Fig. 4 gives the relative time curves of inverse time-lag overload relays of the induction type, set to operate with three different times. For currents exceeding five times those for which the relays are set the time lags reach an almost steady value, and it is this figure which should be taken as the criterion and not the point at which the curve cuts the vertical axis, which is necessarily somewhat indefinite and, moreover, only applies to very small overloads. For this reason relays should invariably be scaled both in overload and short-circuit time-lags. It may be added that no relay can be considered satisfactory unless its time curve becomes practically horizontal at a moderate overload, otherwise the intervals between the operation of successive relays may become too short to allow of one breaker opening the circuit before that next behind it commences to act. It is also essential that the

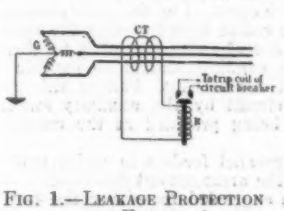


Fig. 1.—Leakage Protection of Feeder.

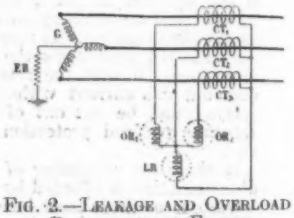


Fig. 2.—Leakage and Overload Protection of Feeder.

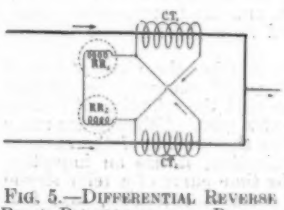


Fig. 5.—Differential Reverse Relay Protection of a Pair of Parallel Feeders.

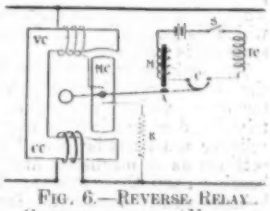


Fig. 6.—Reverse Relay Compensated for Voltage.

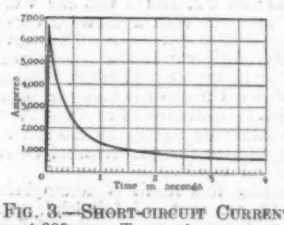


Fig. 3.—Short-circuit Current of 4,000-kw. Turbo-Alternator.

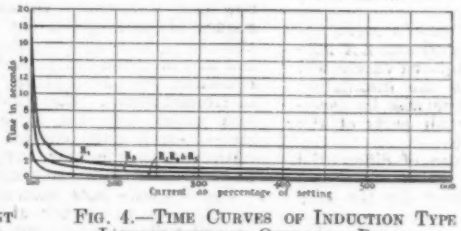


Fig. 4.—Time Curves of Induction Type Inverse-time-lag Overload Relays.

curves corresponding to different settings should follow one another closely throughout. In both these respects the induction relay is much to be preferred to the fuse-shunted solenoid pattern. The only case in which long time-lags are objectionable is when a fault occurs close to the generating station. Should such a fault develop into a dead short-circuit between phases, it is essential to clear it with the least possible delay, the criterion of urgency being the extent to which the voltage is pulled down. A convenient means of applying this principle consists in arranging the tripping mechanism of the relays at the generating station, so that should the voltage fall to, say, 70 per cent. of the normal, the time-lag is automatically shortened to perhaps half a second in each case.

The foregoing remarks refer more especially to the overload relays (O R_1 and O R_2 in fig. 2), but much the same considerations apply to the leakage relays L R, except that, owing to the leakage current being definitely limited by the earthing resistance, there is no great advantage in reducing the time-lag to a minimum. With leakage relays, likewise, there is nothing to be gained by the adoption of a fixed time-lag, although the objections to it may be less strong than in the case of overload relays.

This combination of leakage and overload relays has the important advantage that it is sufficient in itself to deal with faults at any and every point of the system, including the sub-station busbars, whereas many other methods such as the Merz-Price or the "split conductor," whilst excellent in themselves, only control individual sections of the feeders and afford no protection whatever to the sub-station busbars. Moreover, should one of the relays or circuit breakers fail to act, there is absolutely no second line of defence and overload protection by means of fuses is usually advocated in addition, whereby simplicity is sacrificed, and the instantaneous action which is generally put forward as a great feature of such systems is entirely lost.

The leakage relay (L R in fig. 2) takes the place of one of the three overload relays which would otherwise be required for pure overload protection, so that the adoption of leakage tripping does not involve any extra gear. Although too much reliance must not be placed upon the grading of the current-settings as a means of discrimination, it has an important bearing upon the question. The time curve of a relay should become nearly horizontal for currents exceeding, say, four times the setting (see fig. 4). Consequently, if the short-circuit current exceeds this value in the case of all the relays through which it passes in series, each one will operate after the same lapse of time. On most systems, however, such a state of things is very unlikely. Whilst, however, the minimum time necessary for the operation of the breakers should form the basis in arriving at the time intervals between the settings of the relays, nevertheless, a considerable reduction is nearly always possible owing to the discriminating effect of the current settings.

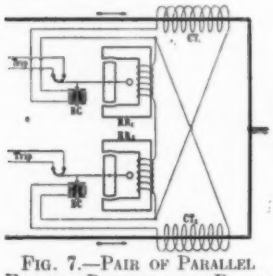


Fig. 7.—Pair of Parallel Feeders Protected by Biased Differential Reverse Relays.

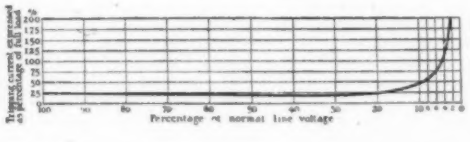


Fig. 8.—Current Required to Operate Relay Fig. 6 under Low-voltage Conditions.

With two parallel feeders, unless the current to earth exceeds the load current at the moment, reversal can not take place, and with three or more feeders the required excess will be still greater. This condition necessitates the installation of a larger earthing resistance than would otherwise be necessary, thus throwing an undue strain upon all parts of the system owing to the heavier fault current.

This difficulty can be overcome by the use of differential reverse relays, the current connections for which are shown in fig. 5, the pressure windings being omitted for the sake of clearness. C T_1 and C T_2 are two current transformers, cross-connected in such a way that a flow of current in the direction indicated by the arrows merely causes a circulation of current in the secondaries, and none flows through the relays R R_1 and R R_2, which are connected in series between equipotential points. On the occurrence of a fault, the currents in the two feeders are no longer equal and the difference current flows through the reverse relays which are so arranged that one or the other operates, according to the direction of the current through them, and thus isolates the faulty feeder alone.

Since the relays operate with a given difference current, it is immaterial whether there is actual reversal or not. A further important advantage is that a surge producing a simultaneous reversal of current in both feeders will not cause either relay to operate.

In the case of four or six parallel feeders, they can be very simply arranged in pairs.

At their outgoing ends, parallel feeders present much the same problem as a single feeder, and may be similarly dealt with by means of combined overload and leakage trips, a group of relays as shown in fig. 2 being applied to each feeder. Graded time-lags must be applied to both the overload and leakage relays. If the fault occurs close to the sub-station the fault current may divide itself almost equally between the two feeders, and there is a risk of the sound feeder coming out instead of the faulty one. Moreover, after the latter has been isolated at the generating station end the fault current will still flow into the sound feeder and may cause its relay to operate. For these reasons it is preferable to install differential reverse relays (fig. 5) at the outgoing end as well as at the other. At the sub-station end the fault current flows in opposite directions through the two current transformers so that the effect upon the relays is doubled, and for this reason the settings may be low, with the corresponding advantages of leakage protection.

If the relays at the outgoing end have isolated the faulty feeder before those at the sub-station the fault current will flow into the sound feeder, and as it then forms the out-of-balance circuit it will operate the relay and isolate the sound feeder as well. To prevent this, the circuit breaker on each feeder should be fitted with an auxiliary contact which, in coming out, renders inoperative the relay on the opposite feeder. At the sub-station end this is unnecessary.

Apart from the fact that a reversal will cause its relay to act, the sound feeder is left without protection. To remedy this, overload relays may be added or the reverse relays can be rendered operative on a heavy forward current. The relay shown in fig. 6 can be arranged to act with such a current if the pressure circuit is opened, which can readily be done by means of an auxiliary switch operated by the circuit breaker as already described. It must not be forgotten that the whole load current now forms the out of balance, and it is, therefore, essential that the relay windings should be capable of carrying this current without overheating. Failing this, he relays must be cut out of circuit by the auxiliary switch, separate overload protection being provided at the outgoing end.

If there are a number of parallel feeders in series perfect discrimination is afforded by the arrangement described.

Various methods have been suggested for giving the necessary "bias" to the relays of fig. 5. What is required is that the bias should increase with the current in the feeders, *i.e.*, should represent a definite percentage of the current flowing. A method of carrying this into effect is shown diagrammatically in fig. 7. R R_1 and R R_2 are a pair of reverse relays, fed by current transformers C T_1 and C T_2, cross-connected as in fig. 5. Besides the usual fixed control, which gives a definite current setting to each of the relays, a biasing coil, B C, applies an additional control which is proportional to the current flowing in the feeders. If this auxiliary control is such as to give a bias of 5 per cent., or at most 10 per cent., it will cover all likely contingencies as regards want of balance. It is usually desirable that the bias should increase rather more than in proportion to the current.

It is of fundamental importance that reverse relays should operate with certainty even if the voltage of the system is pulled down to a small fraction of the normal. The only true solution is to render the reverse relays as far as possible independent of a fall in voltage, and the working principle of a well-known form of such relay is shown in fig. 6. It is a moving-coil instrument having an iron circuit carrying two fixed windings, a current coil C C, and a volt coil V C, so connected as to assist one another with a forward current and to oppose one another with a reversal. The moving coil M C is connected in series with V C and a non-inductive resistance R between phases or to the neutral point, according to circumstances. The windings V C and C C being in opposition under operating (reverse) conditions, the flux in the air-gap for a given current increases rapidly as the pressure falls, and thus largely compensates for the reduced current flowing through the moving-coil winding.

Fig. 8 shows how successfully this result is accomplished. A relay set to operate at 25 per cent. of full load, under normal voltage conditions, will only require twice full-load current to actuate it, even should the voltage of the system fall to 2 per cent. of the normal. Such a result puts the reverse relay upon an entirely different footing, and removes the objection which was at one time so often raised. This form of relay, moreover, can be designed to operate with an exceptionally heavy forward current (say, 20 times the setting) at zero voltage.

(To be concluded.)

Discussion in London.

Mr. E. B. Wedmore explained that several new devices, which had not been discussed before, were incorporated in the paper, but some of them had not been sufficiently fully described. For example, the biased differential reverse relay,

fig. 7, were extremely sensitive in spite of the unbalance in transformers, &c., and it was a very good example of this form of protection. With regard to the protection of a system of two generating stations and four sub-stations, the author's fig. 16, he was not sure that it would do all that might be asked of it. Under certain conditions the generating station relays might operate when the fault was in the sub-stations themselves or in the feeders beyond them. The author's fig. 17 showed a novel arrangement which, however, involved the earthing of the neutral of the H.T. transformers. The author's explanation of the normal voltage triangle and that resulting from a severe short circuit between phases was novel. There was a clear reason why relays which appeared to be good from a theoretical point of view often failed in practice, but he had rarely seen the reason properly explained, and even the author had failed to do so. Compensated differential reverse relays as described by the author, had proved very satisfactory in practice; on a certain overhead system there had been as many as 22 faults in three months, and in every case adequate protection was afforded.

Mr. J. R. Cowie agreed with many of the points put forward in the paper; there were, however, some with which he could not agree. For instance, he thought that it was quite futile to try and obtain discriminating action by giving the various relays different short time-lags. The Merz-Price and "split conductor" systems were preferred by many, yet the last line of defence was often an overload relay at the power station. He personally had a leaning towards the solenoid type of relay on account of its simplicity. This country led the world in the use of protective devices, for which they all owed a debt of gratitude to such men as the author.

Major A. M. Taylor thought the relay shown in fig. 6 had a very excellent feature in the low voltage at which it would operate. With regard to the interruption of large currents, and particularly fig. 3, he had recently been applying the equations established by Steinmetz (in his book on "Transient Phenomena"), to both the case of interrupting the full load current of the station and to that of interrupting the short circuit current. He (the speaker) had introduced into these equations constants more in conformity with the conditions obtaining in this country than were those assessed by Steinmetz, and the equations showed that under bad conditions of feeder arrangement, it was possible, even when breaking the circuit where the current passed through zero, to get voltage oscillations up to double or treble the normal voltage, while if breaking it when the current was at its maximum, they might get anything up to ten, or even twenty times the normal. It, therefore, appeared that two points should urgently be striven for, viz., (1) the use of as many trunk feeders as possible in parallel, when approaching the main station, each absolutely independent of the other (split-conductor protection preferred), so that even a group of feeders might momentarily be thrown out without the main generator circuit being broken; and (2) the use of core-balance, or most delicate protection obtainable, in order to cut out every feeder before the leak to earth had time to develop into even a mild short circuit between phases. He found himself quite at issue with the author on the question of time-lags; the intervals given were altogether too short. He would like to ask the author how he would protect, with differential reverse relays, a group of six feeders in parallel, some of which were 80 per cent. longer than others, and some of which were fed through reactances, while some were direct on the busbars. With reference to the suggestion that combined leakage and overload protection should be applied to the outgoing feeders, unless very coarsely set the leakage relays would bring out both the sound and the unsound feeders. Speaking generally, combined overload and leakage protection were all right for the outskirts of a large system, and for dealing with existing mains—in the absence of anything better; but they were not, in his opinion, suitable for the heavier feeders. In support of the possibility of the short circuit being opened at some time other than when the current was passing through its zero value, it should be considered that the oscillating E.M.F. was at its maximum when the current wave was approaching or leaving zero, and the insulation might, therefore, break down just at that moment, followed by an immediate rush of current, which the forward motion of the breaker must interrupt, at once giving the most dangerous conditions.

Mr. G. W. Partridge agreed that more interruptions of supply were caused by opening circuits prematurely than by leaving a fault on the system for too long a time. It was his opinion that the later the switch acted the better, provided that when it did act it did so quickly. It was quite impossible to interrupt short-circuit currents with an oil switch except at the zero line. From the point of view of speed of action it was preferable to use as small a number of relays as possible; it was not uncommon to go into a station and find all the relays fastened up with string to prevent them acting, or again when they were allowed to act, for them all to come out at once and cause general confusion. A drawback was the failure of relay action owing to the fall in pressure, and in his opinion it would probably be preferable to make use of some device which lowered the short-circuit pressure until the fault could be cleared. With reference to the Brazil resistances, he had one installed some time ago, and it had worked well ever since; he found them perfectly satisfactory.

Mr. H. W. Clothier was of the opinion that the switchgear should be made as simple as possible; such devices as were advocated by the author might find a useful field in the smaller systems or in the less important sections of the larger ones. The method of leakage protection had not been given a chance, the imposing of a time limit cut out every virtue of the thing. It was his opinion that faults should not be allowed to hang on to the system, relays should operate instantaneously. The air-dashpot was more unreliable than the time-limit fuse. With regard to the author's method of bridging the primary winding of the transformer by a non-inductive resistance to form a by-pass for the surge, he thought it would be much more advisable to make a good job of the insulation than to rely on such a method of relieving the strain between the turns of the winding.

Mr. H. Brazil thought the paper an important one, as it not only emphasised this method of protection, but also the placing of the protective devices in their correct positions. In this country protective devices were often placed quite wrongly. The inductive type of relay worked well in practice, and had given good results; he was in favour of the use of inverse time-lag. With regard to earthing through a reactance, he thought the practice was entirely wrong.

Major K. Edgcumbe, in reply, said that the question of earthing the mid-point was looked at from quite a different standpoint to-day, and no very serious objections could be taken to doing so. With regard to the solenoid type of relay, it made quite a satisfactory fixed time relay, but it was useless when an inverse time limit was to be made use of. It was true that they led the world in the use of protective devices, and it was most interesting to follow the work now being done in America and Germany, where the same difficulties were being experienced to-day that had been overcome in this country years ago. With reference to pressure regulators, they were not looked upon as part of the protective gear, and the suggested use of two relays in series was not, in his opinion, advisable.

THE GERMAN ALUMINIUM INDUSTRY.

During the course of the past four years an aluminium producing industry has been created in Germany, partly by the investment of private capital, but mostly with the assistance of considerable funds provided by the Government. Although the industry has not yet become of great economic importance it is claimed to be exercising to some extent a favourable effect on the commercial balance of the country, inasmuch as it affords an opportunity for dispensing with imports of metal manufactures of the most varied kinds, and at the same time permits of the carrying on of a remunerative export trade in manufactures of aluminium. In this connection a German newspaper * gives the following information concerning the industry.

As the utilisation of water power for the production of cheap energy had been neglected, the Government departments concerned with the supply of metals were confronted with great difficulties when the requirements in aluminium enormously increased, and foreign sources of supply were stopped in part. Under these circumstances, attention was first directed to the electricity produced in the lignite districts as being the most readily available, and a basis was first found in the existing works at Bitterfeld and Horrem; next at the coalfields on the Elster, then at the Erft hydro-electric works, and finally at a second water-power installation on the Inn. Apart from an installation at Berlin, which has already been discontinued, four centres of production have been completed and set in operation, all these using alumina which has been previously subject to preparatory treatment. The works are completely organised commercially in private companies, and are joint economic undertakings principally financed by the Government. The works are:—

1. Ver. Aluminium Werke A.G., which was originally formed jointly by the Griesheim-Elektron Co., and the Metall Bank of Frankfort-on-Main. The capital was nominally 50,000,000 marks, but the credit granted by the Government were very considerably greater. The works and estimated capacity are: Lauta, 12,000 tons; Horrem, 3,000 tons; and Bitterfeld, 3,000 tons.

2. Erft Werke A.G., which was constituted by Giolini and the Rhenish-Westphalian Electricity Works Co., with a nominal capital of 15,000,000 marks, and considerably greater expenditure in the form of credits. The estimated productive capacity is 12,000 tons.

3. The Inn Werk A.G., which was established by the A.E.G. and Siemens-Schuckert Works, Giolini, and the Government of the State, the capital being 13,200,000 marks.

The works of the first two (Nos. 1 and 2) companies are in operation, although by no means at their full capacity, whilst the third is apparently not yet producing aluminium. It will be seen that preparations have been made for an annual output of 30,000 tons, but the actual production has not and does not reach these figures. In order to give some idea on this question, it is mentioned that the peace-time imports of

* *Frankfurter Zeitung.*

crude and scrap aluminium ranged from 15,000 to 18,000 tons per annum, representing a former value of 25,000,000 marks, but which would not be far short of 500,000,000 marks at present prices, and taking into account the depreciation of the mark. The production of the works from the beginning of 1916 amounted to 600 tons per month, and in 1917 and 1918 it reached about 2,000 to 2,500 tons monthly, but these quantities were insufficient for the war requirements. After the end of the war the output greatly declined partly in consequence of "strangulation," and partly owing to the general scarcity of coal. A recovery, however, is now proceeding, and technical men estimate the monthly production at present at 1,000 tons or slightly more. The whole of the output is said to be passing into works producing articles of peace—the rolling mills of Stinnes, the electrical industry, and the great metal ware manufacturing industry in Westphalia and Central Germany. The sales organisation of the works—the so-called "Imperial Works"—lies in the hands of the Metall Gesellschaft, of Frankfort-on-Main, but during the war the distribution of aluminium was controlled by the War Metal Co. A comparison of the course of prices per kilogramme is shown below.

German aluminium prices in marks per kilogramme :—

1914 (peace price), 1.50 marks; 1918 to November 18th, War Metal Co.'s price, 5.50 marks; 1918, War Metal Co.'s price on November 19th, 7.00 marks; 1919 to September, 10.00 to 15.00 marks; 1919, November 11th, 22.50 marks; 1919, December 2nd, 27.00 marks; 1920, January 16th, 35.00 marks.

It is difficult to ascertain whether the works have obtained the maximum prices during this period of bounding prices. Sales are said to have been made with which it was impossible for the production to keep pace, so that sometimes—and it is asserted also at present—the deliveries were only carried out at a time when the costs of production and the market prices had already again advanced. It is therefore considered that very little consolation can be assumed from the past as to the remunerativeness of the works, especially as the period was one of construction.

A year ago a very pessimistic opinion prevailed as to the economy of the works, owing to the growth in the working expenses, the rapidly swollen costs of construction which specially exceeded the estimate in the case of the Lauta Works near Hoyerswerda, and the great rise in local wages, whilst the technical-economic efficiency of the Lauta Works failed to come up to expectations. In the meantime, however, the collapse of the exchange has come as an additional burden; the mark which had fallen to one-half of parity in Switzerland at the end of 1918 now stands at one-twelfth. Moreover, the world price for copper, after transitory convulsions, has fairly well maintained its wartime level, at least in London. But the vitality of the inland production of aluminium depends extraordinarily upon both the mark and the price of copper. Every rise in the Swiss franc constitutes a still greater sacrifice in procuring aluminium from Neuhausen, and every mark added to the costs of copper imported or available in the country compels engineers to make use of native aluminium instead of foreign copper, where it is possible to do so, particularly with overhead transmission lines and other products of the electrical industry.

Another factor which cannot be left out of consideration is the fact that pure alumina is required for the production of the metal, and this was for the most part formerly procured from the bauxites in the South of France, Hungary, and the Adria. Considerable quantities were assured, but they will come to an end, and the economy of the industry would again be jeopardised if new foreign raw materials had to be imported. Under these circumstances efforts must be put forth in the direction of finding raw materials for the purpose in Germany, and the basis of the industry will only be firmly established when success has been obtained in this respect.

SCIENTIFIC MANAGEMENT.

At a meeting of the North-Eastern Centre of the Institution of Electrical Engineers, on January 12th, Capt. J. M. Scott-Maxwell read a summary of his paper on "Scientific Management." An abstract of the paper appeared in our issues of December 19th and 26th, 1919. In the subsequent discussion Mr. Arthur Parsons (Messrs. C. A. Parsons and Co.) referred to a system which the firm with which he was connected had adopted, and which had been working for a considerable time. It was devised for a factory where the work was specialised, and where there was not much repetition work. Even before the order was received the planning department got into operation. They could ascertain exactly what was the position of the works, and when they could deliver the goods. Then the tender was submitted, and when it was accepted the planning department planned it out. In illustration of his remarks, Mr. Parsons submitted a diagram, which showed the progress of an order through the works. It was assumed that the order was received on January 1st, and that it had to be out by the end of June. The actual work on the job was shown by a blue line, which also represented a given period of time; yellow lines represented the time allowed for the getting in of the raw materials, mauve lines the time allowed for the making of patterns, &c., and a red line the balance of time. The lines were divided into portions each indicating a given stage in the work. Each portion of a job had to be done by a certain date, and these dates were supplied to each department, and the work of the department was reported on weekly cards. The chief aim of such a system was to get all the work duly to the assembling department. The men worked infinitely better if they had the materials to hand, and the work went much smoother. He agreed that the only way for payment was payment by results. If they could get some suitable method of doing that, arrange their factories on a more scientific method of management, and increase productive capacity, there was a great future for this country.

Sir Thomas Oliver, M.D., said if they were going to carry out scientific management there would arise questions of a psychological character which medical men would have to face, and they could only face the question along with the experts. Mr. Maxwell had referred to boards for research into matters connected with fatigue, and he would like to see workers and the employers associated, so that the experts should have their attention drawn to those matters upon which enlightenment was needed. There were two kinds of fatigue—subjective, which concerned the working man, and objective, which was seen in the character of the man's work. As to subjective, formerly it was thought the seat of fatigue was in the muscles, now it was known that it was not so much in the muscles as in the nervous system. Not only the muscles, but, perhaps, even the heart, was affected slightly in fatigue. Speaking of Taylorism, Sir Thomas said the trade unions did not want to find out how much a man could do. Man's capacity for work varied, as his capacity for fatigue. One man was more easily tired than another, and they did not want that exposed. Taylorism had special advantages, and men made more money with less fatigue under Taylorism than under any other method. What had impressed him upon the question of fatigue was the cry for shorter hours, and the hours became far too low, more than the condition of the body called for. It seemed to him that the question of hours should not be uniform at all, there were certain industries where shorter hours might be introduced, but that did not apply to other industries where liability to fatigue was not so great.

Mr. T. Carter asked how far inspection should actually go, whether one should make a point of inspecting every single thing, or should only go so far as seemed necessary and extend when difficulties occurred? The help of both employers and workmen was very necessary in the problems that had to be faced, and simple suggestions made by employés might have extremely important results. He had in mind one case where a suggestion of keeping records of machines in a particular way made by one of the clerical staff, led, by its subsequent development, to the recording of twenty times as many machines as previously, with only double the staff. The speaker suggested that problems and their proposed solutions should be explained to individuals rather than to masses of men. He also suggested that the staff could probably be used in many ways. The fact that they were able by their position to see both sides made them peculiarly fitted to bring to one side the views of the other in an intelligent way.

Mr. Ranft questioned the figures as to the time taken in handling of tools, which was put down at 75 per cent. of the total time, the handling of the machine, 15 per cent., and the job itself only required 10 per cent. of the total time. Nor did he agree that it was a comparatively easy thing to draw up a plan of work as the paper suggested. He thought the vital thing in all these matters was co-ordination and co-operation.

Mr. Bedworth said he thought that anything that was to succeed must receive the approval of labour, and anything to get the approval of labour must give not only some slight financial gain, but also some mental and physical advantage. He asked, was that system of scientific management, as laid down, going to improve the worker mentally? Everything was cut out for him, everything was thought out for him. There was an elaborate system of timing, was that to increase his mental vision? They knew the time for every operation, for every portion of the job. He did not think the worker would benefit financially. His idea of scientific management was applied common sense.

Prof. Hallsworth looked at the question as a student of economics as likely to give very valuable results. It was likely to lead to the discovery of the most efficient way of doing a thing. He also thought that the system might throw light on the whole question of fatigue. These advantages were so great that they should carry labour with them. But this system must not interfere with collective bargaining, nor lead to the cutting of piece rates. Neither must it reduce the workman to an automaton.

Capt. Scott-Maxwell briefly replied.

Patent Application in Sweden.—A Royal Decree of December 19th, 1919, extends until July 1st, 1920, the time for lodging an application for a patent in Sweden, with priority of date, in respect of any invention for which a patent has been applied for in a foreign State on or after July 31st, 1913.—*Illustrated Official Journal (Patents).*

CONFERENCE OF MANUFACTURERS.

At the Kingsway Hall, Kingsway, London, on Tuesday and Wednesday, February 10th and 11th, a National Conference of Manufacturers and Producers was held under the auspices of the Federation of British Industries. Mr. Peter Rylands, President of the Federation, was in the chair, and in addition to 69 affiliated associations, there were represented nine other organisations and ten research associations. Those represented included the British Electrical Federation, the Provincial Electric Supply Committee of the United Kingdom, and the British Scientific Instrument Research Association.

THE PRESIDENT'S ADDRESS.

MR. PETER RYLANDS, in his opening address, dealt at some length with the economic conditions, as the war has left them in Germany, Great Britain, and the United States. At the present time Germany was an extreme case of a country consuming more than it produced. The conditions prevailing in Germany to-day would seem to make it almost impossible for German industry to make a fresh start. The two alternatives seemed to be national bankruptcy and an absolutely fresh start—a solution which would seem to be imposed by the ordinary operation of economic laws—or the intervention of artificial assistance. The danger of this latter was that it might have the effect of giving temporary relief, and healing rather than curing the disease. Moreover, it might not seem surprising that proposals to assist Germany should be viewed with suspicion and even disfavour if only for the reason that if Germany was rehabilitated she might ultimately work out a policy directed to revenge. On the other hand, there were considerations founded upon our own interest which told heavily on the other side, for a social and economic catastrophe in Germany might have far-reaching consequences.

On the other hand, the United States was suffering because she had too many goods for export, and the rate of exchange was such that it was not to the advantage of other countries to buy more than they were obliged to buy. That position might prove of assistance to Great Britain in finding a solution for her troubles arising out of the fall in the value of the sovereign. This position was discussed at some length, and the view was expressed that any serious development in the export trade of the United States in the near future was not probable, and there might not be such an immense competition from America as we might be inclined to think. One factor which would aid in the adjustment of the rate of exchange was that America should import more goods—although that did not seem likely immediately—and another factor was that American capital should find an outlet in foreign countries instead of all of it being used, as now, for the extension of the home trade. This latter would come in time, when the rate of interest on money employed at home would fall owing to there being less demand for it. Then it would be found to be more profitable to use it abroad.

Discussing Great Britain's position, Mr. Rylands thought we could congratulate ourselves on having borne the shock of the war so well. The great remedy for our troubles was to bring our national expenditure into line with our revenue. The Government was still borrowing at the rate of 1½ millions per day, and it was an essential first step that Government borrowing should cease. Secondly, there must be increased production, because there was no doubt that prices would remain high whatever was done now, owing to the continued excess of demand over the supply. At the same time, manufacturers must always bear in mind that the higher prices reached, the more disastrous might be the fall, which must inevitably come. Therefore, it was necessary that manufacturers should increase their reserves out of profits as much as possible, in order to provide against the day of depression which experience taught was almost inevitable. The duty of manufacturers now was to do all they could to assist increased production, and not even grudge the return of Germany as a world producer; at the same time, they must see to it that the British manufacturers secured the largest possible share in the supply of the world's requirements. The public always believed that combination among manufacturers tended to inflate prices, but he was satisfied that that was a mistaken impression. In times like the present the influence of public opinion was very great, and when a large combination was settling a price policy, public opinion could not be absent from their minds. Where, however, no price organisation existed, and each manufacturer in an industry was pursuing an independent price policy, there was no such restraining effect.

The economic conditions of the United States, Great Britain, and Germany gave ground for anxiety, but no good ground for dismay. He believed it would be wise to restrict importation from the United States to essentials, and to prohibit the import of luxuries and non-essentials. Artificial interference with economic conditions was generally objectionable, and usually brought retribution in its train, but it was not easy to see that a policy of restricting certain imports could have any objectionable consequences, and such a policy could be altered when warranted by a change in the position. The high cost of living in this country was a matter for the most serious concern, and unquestionably could not be controlled by the State by any method which was not economically unsound. Coke was an instance of this. The home fixed price of coke was 20s. per ton, but it was fetching £5 per ton for export. The consequence was that all coke producers who were not steel makers were sending their coke abroad, and whereas many of our blast-furnaces were only turning out half their output because of the shortage of coke, the ports were crowded with coke awaiting export. That was an example of ill-judged interference with economic laws. He asked that artificial interference with private enterprise should cease, and referred to the Whitley Council and Works Committee as likely to bring about a better understanding between capital and labour.

The agenda contained a series of resolutions, which were dealt with seriatim. The first one, which was in two parts, related to

EXPORT TRADE AND FOREIGN EXCHANGES.

SIR ARTHUR STEEL MAITLAND, M.P., late chief of the Department of Overseas Trade, proposed the first part of the first resolution, and in doing so, called special attention to developing certain markets abroad which have not yet been touched to anything like the extent possible. The greatest of such countries, provided a decent Government could be obtained, was the South-Eastern portion of Russia, and that part of the country on either side of the Urals. Next to that, apart from the rather remote speculative possibilities of China, was South America, the surface of the trade of which had scarcely been scratched. The consuming population in South America, which had been cut off from British goods during the war, were not altogether satisfied with the substitutes which they had obtained, and the demand for British goods was extraordinary. After urging the abolition of all control of industry, and the replacement of it by Government assistance in a proper form, Sir Arthur Steel Maitland referred to the impossibility of British manufacturers accepting all orders that were offered them, and pointed out that one of the shrewdest business men had suggested that orders should be placed by British manufacturers with firms in allied countries to be completed on commission. That would help us, and also assist the other countries to get going again.

MR. DE F. PENNEFATHER, M.P. (Association of British Chambers of Commerce), seconded the resolution, which was finally passed in the following form:—

"That as an improvement in the exchange value of the pound sterling is of the utmost importance to this country and can be greatly assisted by the expansion of the export trade, this conference urges upon manufacturers the desirability of setting aside some proportion of their output for export purposes, more particularly articles unessential for home consumption, and adjures the Government to give all possible assistance to production both of our factories and soil, and to the export trade of the country."

MR. HARRY ALLCOCK (British Engineers' Association) supported the resolution, and spoke strongly in favour of the adoption of the metric system. He asked that some reference to the metric system should be made in the resolution.

The PRESIDENT thought that the question was too controversial, and suggested that the proposed addition to the resolution should be withdrawn.

Mr. Allcock agreed to this.

The second part of the resolution, which was proposed by Hon. R. H. BRAND, a banker, and seconded by Mr. A. M. SAMUEL, M.P., was finally passed in the following form, the original draft being altered in the important particulars that the assistance proposed should be in raw materials and not financial assistance:—

(1) That the present economic situation of the world is a danger to civilisation, and that immediate international action is urgently required if adequate steps are to be taken to avert chaos throughout Europe.

(2) That an essential preliminary to such action should be the acceptance of the principle that a decrease of excessive consumption and an increase of production and taxation must be rigorously imposed by all countries who will require assistance in order to arrest and counteract the continuous growth in the volume of outstanding money and of Government obligations and its concomitant, the constant increase of prices, and to ensure that the expenditure of the various countries concerned may be brought within their taxable capacity.

(3) That measures should be taken to assist in the reconstruction of Europe by assistance to those countries whose rehabilitation would otherwise be indefinitely postponed.

(4) That this assistance should take the form of the supply of essential raw materials on terms to be arranged, and which should be supplied by those countries where the trade balance and the exchanges are favourable; it should be restricted to the lowest limit of necessity, and should be devoted only to the restoration of productive processes.

SIR WILLIAM PEAT moved a resolution in the following terms:—

(1) That this conference urges that Government borrowing must cease forthwith, and the consideration of grandiose and expensive schemes must be postponed. Taxation must be

reduced as soon as possible so as to diminish the tendency of capital and enterprise to seek development in foreign countries.

(2) That this conference is emphatically of opinion that a levy on capital is opposed to the best interests of the country, since it would discourage thrift and the investing of capital in productive enterprise; this conference further considers that any such levy must operate inequitably and be highly dangerous to financial stability, and could yield the Exchequer only an unknown proportion of the true value of the property when realised, owing to the universal fall in value which such widespread realisation would produce.

(3) That this conference considers that the taxation of war fortunes cannot be carried out without gross injustice to those whose wealth has increased as the legitimate result of thrift, extra effort, or the normal development of business, and has already contributed its full share in taxation, more especially through excess profits duty and income tax.

(4) That this conference welcomes the abolition of excess profits duty, which was never scientific or equitable, and is now out of date, urges that any tax which it may be found necessary for revenue purposes to introduce in its place shall be designed to inflict the minimum possible hindrance to the development of industry and requests His Majesty's Government to consult manufacturers as fully and freely as possible before deciding on the nature of such a tax.

MR. THOMAS TAGGART (Scottish Association of Controlled Establishments) seconded the resolution, and it was agreed to.

(To be concluded.)

THE ELECTRICAL WHOLESALERS' FEDERATION, LTD.

THIS very practical and businesslike body held its annual meeting on Wednesday last week at the Hotel Russell, London. Delegates were present from the London, Lancashire, Yorkshire, Northern, Midlands, Scotland and South Wales districts. The morning and afternoon deliberations were conducted behind closed doors, but to the luncheon which came between the technical Press was admitted.

What happened at the meeting is not for us to say, but that it was all very interesting goes without saying. So far as the luncheon atmosphere was concerned it was highly charged with a 15 per cent. spirit; precisely what that means members alone may tell to other wholesale factoring firms who wish to join the select and highly prosperous circle. Whether it was due to the present state of the industry or to the benefits of co-operative action under the Federation wing, those present appeared to have very good reason to be pleased with themselves. They did not conceal evidences of deep conviction that they had done a very satisfactory thing in establishing the E.W.F., and were equally convinced that it was going to have a great future. We could not help recalling our tours of the provinces made several years before the war when one had only to tap a factor lightly and floods of grievances as to the state of the trade gushed forth. Association has undoubtedly been a good thing for the wholesalers as it has for the manufacturers. Mr. W. Donovan, who was in the chair, proposed the toast "Success to the Federation," and said that they were making progress in spite of the difficulties of the times through which they had passed. They were rapidly becoming recognised as part of the necessary organisation for the distribution of electrical apparatus throughout the Empire. Born in January, 1914, with twelve members, the Federation now had 53, and they anticipated that very shortly this number would be very greatly increased by the accession of firms who were entirely eligible for membership because they fully complied with the organisation's very rigid specification of a "factor." They took the view that membership of the Association should be the hall mark of a genuine factor, and they had had to ask some firms to excuse them from admitting them. The agreements that they had been able to make with various groups of manufacturers indicated that manufacturers themselves were realising more to-day than hitherto the necessity for the factor, and were abandoning the attitude which many of them had adopted for the exclusion of the factor. Mr. Donovan mentioned an article that had appeared in the *Times* on the Organisation of the Electrical Industry, in which the name of the Federation was coupled with that of the B.E.A.M.A. and the E.D.A. as part of the necessary machinery for distributing the products of the electrical factories throughout the Empire. They had secured attention and recognition—though not the measure of recognition that they desired—from the manufacturer, and they had secured the attention of the Press, and their clients who had known them for so many years knew quite well that they were a necessity and could render very valuable service. It was the Federation's business to see that the manufacturer realised more every day, owing to honest and efficient service rendered, that it was in his interests to grant the preferential terms that they desired, and for clients to continue to extend their business with federated members. Mr. Donovan said that the future of the factor was a bright one; business was good; and without the factor the system of distribution could not be efficient. The future of the Federation was also bright, because without the organisation which it provided the factor would not be able to command the attention and consideration which his position warranted.

A happy incident was provided when the secretary, who has been responsible for so much of the success of the E.W.F. (Mr. A. G. Beaver), was presented with a cheque. Mr. Beaver, after briefly and appropriately responding, moved the toast of the "Technical Press," and after it had been "drunk with enthusiasm," as they say, the emission of brilliant flashes of humour by an always good-humoured and veritable veteran pressman from Maiden Lane was the signal for all to retire for a ten minutes' interval so that the factors might prepare to resume their profound deliberations.

THE ELECTRICAL TRADE OF SPAIN.

ATTENTION has frequently been called in these columns to the industrial development which has been witnessed in Spain during the past five years, and the resultant opportunities for the introduction of electrical machinery and appliances. Conditions are ripe for the further exploitation of Spain's mineral wealth, the utilisation of its water power for the generation of electric current, the electrification of railways, &c. The Americans are keeping in close touch with all these possibilities, and one of their Trade Commissioners recently gave an interesting account of the methods by which Germany succeeded in gaining such a strong hold on the market. That country did the greater part of the business in machinery and installation material, including small industrial motors. Wires and cables, cotton and rubber insulated, and underground cables have long been manufactured in the country. Latterly quite an extension has taken place in Spain's production of motors and transformers.

As regards lamps, there also existed, before the war, the following factories: Compañía General de Electricidad "Metal T," with a production of 5,000 lamps daily; The Sociedad Española de Lámparas Z, producing more than 4,000 lamps daily; and three other small factories. In all, these did not supply more than a third of the local consumption of lamps with metallic filaments. The Siemens-Schuckert Co. owned some construction shops in Cornella (near Barcelona), in which it gave employment to some 500 workmen, and manufactured motors for alternating and direct currents up to 150 H.P., and transformers of all capacities. The Sociedad "La Electricidad," of Sabadell had 300 workmen making motors, transformers, alternators, and centrifugal pumps of moderate capacity. There were also two or three shops of very little importance, among which was one of the Allgemeine Elektricitäts-Gesellschaft-Thomson Houston Ibérica doing small repair work. This was the state of the market in 1913 and until the middle of 1914.

The domination of the German industry was absolute, due almost exclusively to commercial methods, which were very much in harmony with the financial condition of Spain at that time, and above all to the customs and inclinations of the majority of the national merchants.

There stands out among these methods the consigning of stocks of motors and other machines to large and accredited resale agents in the provincial capitals, and the extension to them of very appreciable facilities for making payments. These facilities were also extended to the purchaser and to central stations of the second class, even to those which in certain articles (such as meters, for example) enjoyed the privilege of paying in 10, 12, 16, and up to 20 months, in graduated instalments, by means of accepted drafts.

Their travelling salesmen and order takers were almost exclusively Spaniards, as they were received in business houses with greater sympathy than were foreigners, and, being more familiar with the character and peculiarities of each region were able to derive more profit from the business.

During the war the German houses were obliged to overcome great difficulties; but, in spite of all, they conserved a large part of their domination of the market. The Allgemeine Elektricitäts-Gesellschaft received material from Germany via Italy until that country joined the Allies. It also received large shipments from the United States until she entered the war. Since then the company has enlarged its shops, in which to-day it employs some 200 workmen constructing small motors and transformers. Siemens-Schuckert amplified and intensified the production of its shops in Cornella, and has very materially bettered its situation in the market, as far as the possibility of supplying small machinery from its factory is concerned.

Neither of these houses could do anything with large apparatus, and advantage of this fact has been taken by the Brown-Boveri Oerlikon and Allmanna Svenska companies.

From Italy many small motors (up to 5 H.P.) have been imported, and a few in sizes as large as 100 H.P.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Improved Earthing Device.

Mr. S. Lees, 89, Green Street, Middleton, Lancs., has invented a device to render the earthing of a conduit installation more efficient. This consists of a lug or extension piece

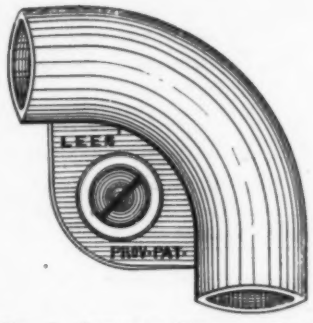


Fig. 1.—Improved Earthing Device.

forming a part of the tubing (fig. 1). This lug is fitted with a bolt, nut, and washer, by which the earthing wire is clamped. All bends and joints can by this means be securely earthed.

The Peerless Electric Car Lighting and Starting Set.

A new electric lighting and engine starting set for use on petrol motor cars has lately been put on the market by the Peerless Engineering Co., of Cote Hill, Halifax. The lighting dynamo, fig. 2, which is made in three sizes, of respectively 45, 90, and 120 watts, and 6, 12, and 12 volts capacity, is of the constant-current type, and of cylindrical form. The armature is substantially made, and runs on ball bearings, the maximum speed being 1,500 r.p.m. Three brushes are provided, these being accessibly placed inside the commutator end. The brush gear and commutator housing is enclosed by a steel band which clips over the housing and automatically secures itself in position. The regulation of output is effected electrically within the dynamo, partly by the special armature construction, and partly by the third brush circuit, the result being that the field, after a pre-determined speed has

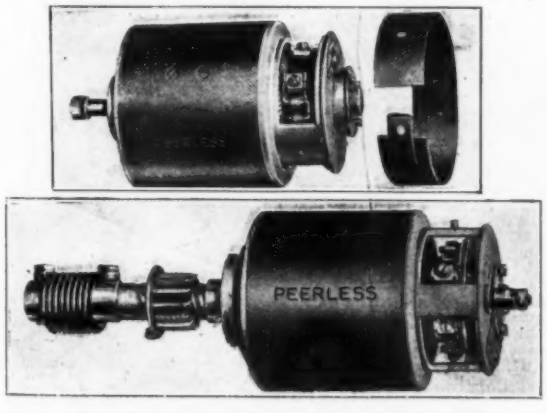


Fig. 2.—Peerless Motor-car Lighting (above) and Starting (below) Equipment.

been attained, is to some extent demagnetised. The dynamo cable is anchored by a neat and secure device so arranged as to ensure both a good electrical connection and a waterproof joint for cables of varying diameters.

The cut-out is a separate fitting containing a fuse for protecting the field winding. A triple cable connects the dynamo and switchboard with the cut-out, the arrangement being such as to facilitate the wiring and to avoid joints and the necessity for a junction box. The battery supplied with the equipment consists of 2-volt unit cells built up to give 6 or 12 volts as required, the accumulators being supplied in either celluloid or ebonite cases.

The engine starter, fig. 2, which is of the four-pole type, is designed on the same general lines as the dynamo; the armature runs on ball bearings, and the windings are of the series type designed for producing a powerful torque. The engaging mechanism is of the standard inertia pinion pattern, a strong spiral spring being embodied to take up any shock on the engagement of the pinion with the toothed flywheel of the engine. Three sizes of the starter are being made, intended for engines of respectively 12, 25, and 50 h.p. The starter is operated by a pedal switch of neat and simple design, and arranged to be fixed under the driver's footboard, only the pedal projecting through.

New "Falco" Cooker.

The accompanying illustration relates to one of the "Falco" domestic or household ranges, made by the Falkirk Iron Co., Ltd., Falkirk, which was remodelled about seven months ago, and has since then been subjected to prolonged tests with very satisfactory results. Fig. 3 shows the new model, which is complete with switches and fuses mounted upon it, the main terminal box being at the back; this, besides being cheaper than the models with separate switchboards, makes the cooker more portable and more easily installed. The range itself is constructed of cast iron and mild steel plate, and the overall dimensions are 43 in. by 27 in. by 40 in. high, the oven having an available cooking space of 12 in. by 15 in. by 14 in. high, and the hot cupboard being 18 in. by 19 in. by 5 in. high.

The oven bottom is raised 8 in. from the floor, and a trivet of cast iron, ground and polished, is fitted flush with it, making the equipment very convenient for working. A clear space is left underneath the oven to facilitate washing and cleaning of the floor. The heating elements in the oven are fitted in the sides, are interchangeable, and are arranged for various degrees of heat regulation; they are protected by strong guards carrying the runners, whilst a thick lagging of heat-insulating material separates the inner and outer cases. Over the oven is mounted a hob enclosing the hot chamber, which is warmed by borrowed heat from the hot plates and grill. As is usual with this type of "Falco" cooker, the hot plates are cast solid with the hob, forming two intensified heat sections, the remainder of the surface being also heated to varying temperatures according to position. Various cook-

Fig. 3.—"Falco" Cooker, Opened.

ing operations can therefore be carried out over the whole surface of the hob, as well as grilling or toasting on the grill, which throws the heat downwards.

Fig. 3 gives a general view of the hob opened out for inspection, an operation that can be performed instantly, as it is not fixed except by the hinge pins. A loose enamelled crown plate fits underneath the hob, and a shallow skirting at the back. The equipment of the cooker consists of a

strong grill pan and grid, with close and perforated shelves for the oven. The whole of the electrical parts and heating elements can be opened out for inspection without the aid of a screw driver or tool of any sort, the accessibility of these parts being one of the chief features. The main terminal box at the back opens out, and all the wiring can be exposed at a moment's notice. The leads are of bare solid wire where there is the slightest suggestion of heat, but from the main terminal box to the switch boxes at the sides, Association cable is drawn through standard conduit, and as this conduit is heat insulated with slag wool, and the linings of the oven stand ¼ in. off the body, the cables are quite cool.

The loadings of the various elements are as follows: Oven, 2 KW.; grill, 1 KW.; hot plates, 1.5 KW. each; total, 6 KW.

We are informed that the company has received orders for a very large number of these cookers, which can be delivered from stock.

NEW PATENTS APPLIED FOR 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

3,090. "Luminous current-indicating apparatus for electric irons, &c." H. J. FURSE. February 2nd.

3,121. "Electric reciprocating engine." H. PEARSE. February 2nd.

3,132. "Continuous-current generator for constant intensity of current." H. FRITZE. February 2nd. (Germany, May 6th, 1919.)

3,156. "Electric fires." H. H. BERRY. February 2nd.

3,162. "Spark plug." W. C. ROLLINS. February 2nd.

3,186. "Electric induction apparatus." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). February 2nd.

3,197. "Electric generators or motors." F. R. F. Ramsay. February 2nd.

3,217. "Electric furnaces." L. TAGLIAFERRI. February 2nd.

3,218. "Reception of continuous waves in wireless telegraphy." W. A. APPLETON and A. K. MACRORIE. February 2nd.

3,219. "Wireless telegraphy and telephony." G. A. IRVING and A. K. MACRORIE. February 2nd.

3,220. "Electric relays for electric valve sets in wireless telegraphy and telephony." A. K. MACRORIE and G. SHEARING. February 2nd.

3,221. "Detection of high-frequency currents for wireless telegraphy and telephony." W. A. APPLETON, S. H. LONG and A. K. MACRORIE. February 2nd.

3,222. "Low-frequency amplification in electrical circuits for wireless telegraphy and telephony." S. H. LONG and A. K. MACRORIE. February 2nd.

3,223. "Holders for electric valves in wireless telegraphy." H. M. AIREY and A. K. MACRORIE. February 2nd.

3,224. "Thermionic valves and their circuits for wireless telegraphy and telephony." H. M. AIREY and A. K. MACRORIE. February 2nd.

3,231. "Distribution in single-phase and two-phase alternating-current systems." A. M. TAYLOR. February 3rd.

3,248. "Leading-in wires and filaments for electric lamps." S. O. COWPER-COLES. February 3rd.

3,272. "Sparking plugs." A. H. SMITH and A. WIGMORE. February 3rd.

3,286. "Incandescent electric lamps, &c." J. T. CALLAWAY. February 3rd.

3,292. "Insulators for electrolytic systems." A. S. GUSH. February 3rd.

3,305. "Cooling-devices for electrical apparatus." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). February 3rd.

3,307. "Electrically-driven machines." E. J. HARMAN and E. LE BAS. February 3rd.

3,312. "Electrodes for electric arc welding and metal cutting." W. H. BOORNE. February 3rd.

3,313. "Magnetic valve-operating mechanism." W. C. HARRIGAN and R. A. NYE. February 3rd.

3,336. "Alternating-current electric machines." AKTIESELSKABET JYDSK ELEKTRO. February 3rd. (Denmark, April 12th, 1919.)

3,347. "Electric incandescent lamps, &c." A. WOOSNAM. (Naamlooze Vennootschap Metaaldraadlampenfabriek, Holland.) February 3rd.

3,348. "Electric valve or lamp relay and intervalve transformer." G. A. MATHIEU. February 3rd.

3,350. "Electric incandescent lamps." S. WALDNER. February 3rd.

3,352. "Telephones." R. L. MURRAY and TELEPHONE MANUFACTURING Co. February 3rd.

3,358. "Transmitters for wireless telephony." G. A. IRVING and A. K. MACRORIE. February 3rd.

3,360. "Internal-combustion engines and self-contained electric lighting units." BOULTON & PAUL and G. E. FISKE. February 4th.

3,375. "Method of producing tungsten incandescent lamps." DEUTSCHE GASGLUHLICHT AKT. GES. February 4th. (Germany, February 17th, 1919.)

3,407. "Sparking plugs." T. BRADFORD. February 4th.

3,413. "Electric switches." P. B. HANDLEY. February 4th.

3,428. "Reception of telegraphic signals." H. J. HINKS. February 4th.

3,446. "Alternating-current electric machines." AKTIESELSKABET JYDSK ELEKTRO. February 4th.

3,465. "Safety fuses for electric circuits." E. ANTINORO. February 4th.

3,471. "Regulating systems for electric circuits." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). February 4th.

3,491. "Method of evacuating bulbs of electric incandescent lamps, &c." DEUTSCHE GASGLUHLICHT AKT. GES. February 4th. (Germany, May 18th, 1918.)

3,492. "Electric current-interrupters." F. S. ENRICH and C. P. SERRANO. February 4th.

3,498. "Electrical transformers." F. E. BERRY. February 4th.

3,504. "Low-tension wiring system for Ford engines." P. W. CORLESS. February 4th.

3,517. "Driving dynamos." S. H. VAN ABBOTT, E. W. SCAMMELL and SCAMMELL & ABBOTT. February 5th.

3,524. "Electro-deposition of iron." S. O. COWPER-COLES. February 5th.

3,565. "Electric-current generators for motor vehicles, &c." E. A. WATSON. February 5th.

3,566. "Automatic switches for motor vehicle, &c., electricity systems." C.L.I. MANUFACTURING Co. and E. A. WATSON. February 5th.

3,567. "Electric generators for motor vehicle, &c., lighting and ignition systems." C.L.I. MANUFACTURING Co. and E. A. WATSON. February 5th.

3,568. "Electric gas lamps with glow discharge." J. PINTSCH AKT. GES. February 5th. (Germany, April 26th, 1918.)

3,569. "Electric gas lamp with glow discharge." J. PINTSCH AKT. GES. February 5th. (Germany, October 18th, 1918.)

3,590. "Ignition systems for internal-combustion engines." DAYTON ENGINEERING LABORATORIES Co. February 5th. (United States, November 11th, 1918.)

3,596. "Telephones." R. L. MURRAY and TELEPHONE MANUFACTURING Co. February 5th.

3,605. "Lamp-holders for electrac incandescent lamps." P. B. DOWNS. February 6th.

3,606. "Telegraphic, &c., circuits for ionic tubes or valves." W. H. ECCLES. February 6th.

3,610. "Electric torches or lamps." W. BERRY and H. G. EVANS. February 6th.

3,615. "Brush-gear for dynamo-electric machines." J. H. BOYD, CAMPBELL & ISHERWOOD and W. C. ROUSE. February 6th.

3,627. "Terminals for electric cables." J. E. BARROWS. February 6th.

3,647. "Electrical indicators for railways, &c." J. GARDNER. February 6th.

3,650. "Incandescent electric lamps." H. J. OSBORN. February 6th.

3,665. "Electrical appliance." S. F. CANNON. February 6th.

3,675. "Radio-sensitive materials." O. BLOCH, ILFORD, LTD., F. F. RENWICK and B. V. STORR. February 6th.

3,701. "Systems of regulation for electric circuits." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). February 6th.

3,722. "Dynamo-electric apparatus." W. J. MELLERSH-JACKSON (Neuland Patents, Ltd.). February 6th.

3,726. "Actuating device for magneto-electric ignition apparatus for explosion engines." R. E. HEERD. February 6th. (Germany, July 10th, 1919.)

3,727. "Magneto-electric ignition apparatus for explosion engines." R. E. HEERD. February 6th.

3,741. "Coil ignition apparatus for internal-combustion engines." D. A. V. RIST. February 6th.

3,750. "Railway signalling systems." AUTOMATIC TELEPHONE MANUFACTURING Co. February 7th.

3,756. "Method of shaping steel, &c., articles by electric heating." W. J. READETT. February 7th.

3,758. "Generation and application of high-frequency sound waves." T. F. WALL. February 7th.

3,776. "Means for connecting electric light and power cables with junction boxes, distributing boards, &c." R. S. WOODS. February 7th.

3,783. "Regulating devices for controlling electrical air-heating apparatus." E. P. DYER. February 7th.

3,790. "Electron discharge devices." BRITISH THOMSON-HOUSTON Co. and J. GRAY. February 7th.

3,797. "Electric coin-freed automatic machines with money-counting and change-delivery devices." R. BERTSCHINGER and J. J. PRINZING. February 7th. (Switzerland, September 16th, 1919.)

3,803. "Electric switch-boxes, &c." W. T. HENLEY'S TELEGRAPH WORKS Co. and W. H. NICHOLS. February 7th.

3,810. "Electric cables." F. JENKINS and H. LUCAS. February 7th.

3,811. "Spark plugs." A. OPPENHEIM. February 7th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1918.

12,567. ELECTROLYTIC APPARATUS. E. O. Benjamin. August 1st, 1917. (137,553.)

21,285. PRODUCTION OF HIGH-FREQUENCY ELECTRIC CURRENTS. F. J. Brougham. (M. Deutsch.) December 19th, 1918. (137,564.)

1919.

496. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. L. Macquaire. January 9th, 1918. (122,408.)

893. ELECTRIC FUSE CARTRIDGES. G. A. Conrad. January 13th, 1919. (137,590.)

894. ELECTRIC FUSE SUPPORTING PLUGS. G. A. Conrad. January 13th, 1919. (137,591.)

910. ELECTRIC LIGHT SOCKETS. H. H. Melaun. January 13th, 1919. (137,592.)

1,732. ELECTROLYTIC CELLS. H. W. Matheson and F. T. Kaelin. January 23rd, 1919. (167,609.)

1,841. AUTOMATIC CUT-OUTS AND SUBSTITUTIONAL RESISTANCES. G. E. Tate and F. O. Monkhouse. January 24th, 1919. (137,612.)

2,295. CONTACT-BREAKERS FOR MAGNETOS. D. C. Dingley and G. Major. January 30th, 1919. (Cognate application 15,972/19.) (137,622.)

2,458. ELECTRIC FUSIBLE CUT-OUTS. V. E. Joyce and Park Royal Engineering Works. January 31st, 1919. (137,623.)

2,816. HOLDERS FOR ELECTRIC LAMP SHADES. H. Ward. February 5th, 1919. (137,629.)

3,223. DYNAMO-ELECTRIC MACHINES. P. A. H. Mossay, H. C. E. Jacoby and Enclosed Motor Co. February 10th, 1919. (137,635.)

3,372. APPARATUS FOR OBTAINING CONTINUOUS OR DIRECT CURRENT FROM AN ALTERNATING CURRENT CIRCUIT. A. Bopp et Cie. February 15th, 1918. (123,321.)

3,676. ELECTRICAL STORAGE CELLS. Van Raden & Co. and H. C. Smith. February 14th, 1919. (137,641.)

4,469. ELECTRIC IRON. R. F. Bruce and Portholme Aircraft Co. February 22nd, 1919. (137,652.)

5,639. ELECTRIC MAGNETIC RINGS, BRACELETS, THIMBLES, AND THE LIKE, AND THE MANUFACTURE OF THE SAME. R. C. Roden. March 7th, 1919. (137,667.)

6,338. ELECTRICAL DEVICE INTENDED FOR USE CHIEFLY AS A TOY. E. L. N. Nelson and E. A. Reynolds. March 13th, 1919. (137,675.)

7,117. MEANS FOR ACTUATING ELECTRIC SWITCHES FOR CONTROLLING ELECTRICALLY-DRIVEN PUMPS. A. Dispot. March 21st, 1918. (124,747.)

8,783. MAKE-AND-BREAK DEVICES FOR MAGNETOS AND THE LIKE. E. Harrison. April 7th, 1919. (137,704.)

11,538. DYNAMO-ELECTRIC MACHINES. M. Chassin. May 11th, 1918. (126,644.)

12,528. CLIP OR FASTENER FOR CONNECTING ELECTRIC TERMINALS, WIRE, OR THE LIKE. R. Richardson. May 19th, 1919. (137,734.)

12,686. METHOD OF AND APPARATUS FOR GROUPING AND SUPPORTING ELECTRIC LAMPS FOR DECORATIVE ILLUMINATION PURPOSES. F. W. Bundy and H. Bey. May 20th, 1919. (137,736.)

15,132. ELECTRIC CHAIN-WELDING MACHINES. G. J. Armstrong. June 16th, 1919. (137,748.)

16,399. HOLDERS FOR ELECTRIC LAMPS AND APPLIANCES THEREFOR. G. H. Ide and General Electric Co. June 30th, 1919. (137,754.)

16,788. ELECTRICAL CONNECTION BOXES FOR ELECTRICALLY-OPERATED CRANES OR MACHINERY. Siemens Bros & Co. and H. G. Wood. July 4th, 1919. (137,756.)

17,974. TELEPHONE LEAD AND THE LIKE COUPLINGS FOR KITE BALLOONS AND THE LIKE. O. S. Stiles. July 18th, 1919. (137,763.)

20,012. ELECTRIC CIGAR LIGHTERS, PIPE LIGHTERS, AND THE LIKE. M. J. Railing and R. J. H. Hill. August 14th, 1919. (Addition to 119,141.) (137,769.)

22,290. AUTOMATIC REGULATION OF THE PARALLEL WORKING OF VARIABLE-SPEED DYNAMOS AND ACCUMULATORS. F. Mauron. September 10th, 1918. (132,519.)

22,600. ELECTRIC LIGHTING FIXTURES. H. C. Adam. October 8th, 1918. (133,673.)

26,596. MULTIPLE FUSES FOR ELECTRIC CONDUCTORS CARRYING HIGH-VOLTAGE CURRENTS. O. Cracoanu. May 27th, 1919. (137,793.)